

Energy Assessment

**Wetherby House, 15 Green Lane, Northwood
(Pembroke House)**

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Executive Summary

This Energy Assessment has been prepared in response to Condition 15 and Condition 18 1) relating to the consent granted for the erection of a residential building comprising 12 flats with associated parking, following the demolition of the existing building on land at Wetherby House, 15 Green Lane, Northwood.

The methodology used has been based upon the policy in the London Plan (and provided in 'Energy Assessment Guidance' published by the Mayor of London) and uses the carbon factors for gas and electricity proposed for SAP 10.

The fabric standards of the building exceed the requirements of the Building Regulations.

In order to demonstrate the energy efficiency of the building a set of SAP calculations have been prepared for the 'Be Lean' scenario based on the use of gas boilers to each apartment. This is not the proposed strategy but purely demonstrates the reduction from the 'Be Lean' condition.

The SAP Worksheets for this option are attached as Appendix 1 and the 'Be Lean' GLA spreadsheet based on the SAP 10 carbon factors is attached as Appendix 2.

It is proposed to provide space heating and hot water to the apartments using a communal heat network which will be heated using air source heat pumps. SAP calculations have been prepared for the 'Be Clean' scenario based on the use of ASHPs.

The SAP Worksheets for the proposed option are attached as Appendix 3 and the 'Be Clean' GLA spreadsheet based on the SAP 10 carbon factors is attached as Appendix 4.

In order to maximise the reduction in emissions it is also proposed to install a photovoltaic array of 12 x 350W photovoltaic panels (4.2 kW). The panels will be installed on the flat roof section of the main roof and inclined at circa 20 degrees, orientated towards due south.

A Roof Plan showing the indicative layout of the panels is attached as Appendix 5.

The heating solution to the building proposes an all electric installation and therefore there are no on site carbon emissions or nitrogen oxide emissions. The strategy therefore complies with the requirements of Condition 18 1).

The reductions in emissions can be summarised as follows:

	Total Emissions	% Reduction
	T CO ₂ per year	
Be Lean		
Baseline (Building Regulations TER) – based on gas	15.667	
Be Lean - after energy efficiency (DER) – based on gas	14.100	10.00%
Be Clean		
Emissions – after heat pumps (Be Clean)	6.120	60.94%
Be Green		
Emissions – after renewable technologies (Be Green)	5.226	66.64%

The residual emissions are 5.226 tonnes and therefore, using the carbon offset charge the payment should be **£14,894** (5.226 x £2,850).

1.0 Introduction

This report has been commissioned by Westcombe Homes and provides an Energy Assessment in response to Condition 15 and Condition 18 1) relating to the consent granted for the erection of a residential building comprising 12 flats with associated parking following the demolition of the existing building on land at Wetherby House, 15 Green Lane, Northwood.

The Conditions say;

15. *Prior to commencement of development, an Energy Assessment for the 12 units hereby approved, shall be submitted to, and approved in writing by, the Local Planning Authority. The assessment shall set out the annual baseline regulated energy demand (kwhr) as per 2013 Building Regulations (or subsequent amendments) and associated carbon emissions (kgCO₂ and tCO₂). The assessment shall then set out the measures and technology required to achieve a 100% reduction (zero carbon) in the CO₂ associated with the baseline regulated energy demand; these measures must be sufficiently evidenced with corresponding details and specifications including the location of low and zero carbon technology (i.e. roof plans showing the inclusion of PV panels). The updated Energy Assessment must clearly set out any shortfall (tCO₂) of the zero carbon standard. The development must proceed in accordance with the approved updated Energy Assessment.*
18. *Development hereby approved shall not be occupied until a low emission strategy. (LES) has been submitted to and approved in writing by the Local Planning Authority. The LES shall specify the following:*
- 1) *Any CHP or gas boiler will have to conform with the London Ultra Low NOx requirements;*

The report describes the methodology used in assessing the development and the initiatives proposed.

The building has been designed and will be constructed to reduce energy demand and carbon dioxide emissions. The objective is to reduce the energy demand to an economic minimum by making investments in the parts of the building that has the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric. Once a cost-effective structure has been designed, low-carbon and renewable technologies have been considered for installation to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.

2.0 Assessment Methodology

The carbon dioxide emissions from the building have been established using agreed building specifications and detailed working drawings. SAP calculations have been prepared for the apartments based on different scenarios. SAP Worksheets are attached as Appendices 2 and 4 for the 'Be Lean' and 'Be Clean' scenarios respectively.

Emission Factors

The CO₂ emission factors, where applicable, used throughout this report have been taken from the emerging Building Regulation Approved Document L - 2021.

	kg CO ₂ /kWh
Mains gas	0.210
Grid supplied and displaced electricity	0.233

3.0 Proposal

The proposal is for the construction of 12 apartments. The accommodation schedule in detail is;

Unit Type	Number	Area	Total Area
		m ²	m ²
1-Bedroom apartment	2	58.8	117.6
2-Bedroom apartment	4	73.7	294.8
2-Bedroom apartment	4	79.4	317.6
2-Bedroom apartment	2	102.3	204.6
Total	12		934.6

4.0 Energy Efficiency

4.1 Demand Reduction (Be Lean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical. It is possible to exceed Building Regulations requirements (Part L - 2013) through demand reduction measures alone, which typically include a combination of passive design measures (e.g. building design and efficient building fabric) and active design measures (e.g. variable speed motors).

Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The position of the building within the site is in context with surrounding development and the shape of the site.

Natural Daylighting

The orientation and the size of the windows have been optimised to maximise the amount of natural daylight and therefore reduce the demand for artificial lighting.

Efficient Building Fabric

Building Envelope

U-values of the building envelope must meet Building Regulations Part L standards and further improvements to U-values will reduce the apartments heating requirements.

Ground floors will be insulated with 120mm Kingspan K103 PIR insulation.

The external walls will be built using either a traditional cavity wall construction with a 100mm cavity partially filled with 90mm of Kingspan K106 insulation or timber frame construction with a 50mm Low e cavity and 100mm Kingspan K112 insulation between studs and 32.5mm of Kingspan K118 insulated plasterboard internally.

All roofs will be insulated with 150mm Kingspan K7 insulation between rafters with 52.5mm of Kingspan K118 insulation beneath.

Windows are proposed as double glazed with Low 'e' soft coat and argon filled.

The following U-values have been calculated for each element:

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m ² K	W/m ² K	
Ground Floor	0.20	0.13	35%
External Walls (masonry)	0.30	0.17	43%
External Walls (timber-frame)	0.30	0.17	43%
Roof	0.20	0.13	35%
Windows	2.00	1.40	30%
Entrance Doors		1.40	

Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building

The Building Regulations set a minimum standard for air permeability of 10 m³ of air per hour per m² of envelope area, at 50Pa.

It is proposed to achieve a 50% improvement over Building Regulations and the building will target a permeability of 5.0 m³/hr/m².

Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO₂ reduction targets set out in this strategy.

The SAP calculations have been based on the use of the Concrete Block Association calculated Ψ values and 2D thermal models and will enable the building to achieve the higher energy efficiency requirements of the Building Regulations.

Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2006 to address the possibility of overheating and poor air quality.

Ventilation to the apartments will be provided by a System 1, intermittent extract fan installation.

Active Design Measures will include;

Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Approved Document L1A requires three in four light fittings (75%) to be dedicated low energy fittings.

The homes will exceed this and all light fittings will be of a dedicated energy efficient type.

External lighting will be fitted with time controls and light sensors to ensure illumination is restricted to required times. External lighting will be limited to a maximum fitting output of 150w.

Space Heating and Hot Water

The baseline SAP modelling has been based upon the use of a combination boiler installed to each apartment but the assessment considers other options for providing space heating and hot water.

4.2 Establishing Energy Demand and Carbon Dioxide Emissions (Be Lean)

The GLA Energy Assessment Guidance requires the energy efficiency of a building (Be Lean) to be expressed using a gas heating system as a baseline.

The SAP Worksheets are attached as Appendix 1 and the energy demand calculated has been input into the spreadsheet attached as Appendix 2 to provide the emissions based on the SAP 10 carbon factors.

Summary

The maximum allowable carbon dioxide emissions from the site (TER) are assessed as **15,667 kg CO₂ per year**, with the actual carbon dioxide emissions (DER) assessed as **14,100 kg CO₂ per year**.

The reduction in emissions from energy efficiency for the 'Be Lean' scenario and using the SAP 10 carbon factors is **1,567 kg CO₂ per year**, which equates to a reduction of;

- **10.00%**

The GLA Guidance requires a minimum reduction of 10% at the Be Lean stage and therefore, the proposed construction complies.

4.3 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Green Lane to be 5.3 m/s at 10m above ground level and 6.1 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. In addition the use of wind turbines will have a detrimental aesthetic impact on the appearance of the development.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

Consequently CHP can demonstrate significant CO₂ savings and although not necessary classed as renewable energy (depending on the fuel used) the technology is low carbon.

For a CHP plant to be economic it needs to operate for as much of the time as possible (usually deemed to be in excess of 14 hours per day) and therefore the size of the unit are usually based upon the hot water load of the building (s) with additional boilers meeting the peak space heating demand.

There is insufficient baseload to justify a CHP unit and therefore this technology is not proposed.

However, the building could be served by a community heating system and this is considered below.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12° C. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

There is insufficient external area to install a shallow, horizontal collection system and in order to use ground source heat pumps the collection system would need to include a number of boreholes.

These would be cost prohibitive and the installation of ground source heat pumps is not proposed.

Solar

(i) Solar Water Heating

Solar hot water panels use the sun's energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees

In apartment buildings servicing apartments below the top-floor can be problematic for solar thermal panels. The total hot water demand of the two top-floor apartments is 3,030 kWh per year (based on the gas system) and assuming panels would reduce demand by 50% the reduction in CO₂ emissions would be 318 kg CO₂ per year. When combined with the energy efficiency measures incorporated into the scheme this equates to a total reduction of 12.03%.

Solar hot water panels could be used to reduce emissions but additional technologies would be required to achieve the policy target and the use of solar hot water heating panels would require the installation of hot water cylinders in each apartment.

Solar hot water heating panels are not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels. The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The design of the pitched roof is complicated and is not suited to the installation of panels. However, the building contains a flat roof element and could accommodate a number of photovoltaic panels, which would not impact on the aesthetic of the development. The Roof Plan attached as Appendix 5 demonstrates a total of 12 panels could be installed. These would be installed on racks and gently inclined at circa 20 degrees towards due south and assuming the installation of 350W panels the total reduction in emissions from the array would be **894 kg CO₂ per year**.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

The use of a communal system is appropriate and it is proposed to install an air source heat pump into all residential units. Each apartment will have its own indoor unit, which will be connected to a common outdoor unit.

4.4 Establishing Energy Demand and Carbon Dioxide Emissions (Be Clean)

Using the methodology set out in the Mayor of London's 'Energy Assessment Guidance', the carbon emissions have been calculated using the new carbon factors proposed as part of the new Part L of the Building Regulations, which will be published in 2022 but using the existing SAP methodology (2012).

It is proposed to install an air source heat pump system into each apartment. Each apartment will have its own indoor unit, which will be connected a common outdoor unit.

The SAP Worksheets for the proposed solution are attached as Appendix 3 and the energy demand calculated has been input into the spreadsheet attached as Appendix 4 to provide the emissions based on the SAP 10 carbon factors.

Summary

The actual carbon dioxide emissions (DER) are assessed as **6,120 kg CO₂ per year**, which equates to a reduction of;

- **60.94%**

4.5 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

Be Lean

A baseline calculation has been prepared using 2013 Building Regulations and the SAP 10 carbon factors. Using the current Regulations and based upon a gas heating system for the apartments the total site CO₂ emissions are calculated as **15,667 kg CO₂ per year** (TER) and **14,100 kg CO₂ per year** (DER).

This equates to a reduction of **1,567 kg CO₂ per year** or **10.00%** of the total TER emissions. The reductions from energy efficiency are therefore compliant with the GLA energy planning guidance. The SAP Worksheets for the apartments are attached as Appendix 1 and the SAP 10 'Be Lean' spreadsheet is attached as Appendix 2.

Be Clean

A further set of calculations has been prepared for the proposed energy strategy. This proposes the installation of a communal heating system using air source heat pumps providing space heating and hot water to all apartments. These calculations have been converted to SAP 10 emissions and the 'Be Clean' spreadsheet is attached as Appendix 4. The SAP Worksheets for the apartments and based on the proposed strategy (based on Part L – 2013) are attached as Appendix 3.

The actual carbon dioxide emissions (DER) are assessed as **6,120 kg CO₂ per year**.

The reduction in emissions using from energy efficiency and heat pumps and using the SAP 10 carbon factors is **9,547 kg CO₂ per year**, which equates to **60.94%**.

Be Green

In addition, it is proposed to install a photovoltaic array of 4.2 kW on the roof of the building. The array will be comprised of 12 x 350W panels, which will be installed on racks and gently inclined at circa 20 degrees towards due south. The panels will reduce emissions by a further **894 kg CO₂ per year** and a Roof Plan showing the indicative location of the panels is attached as Appendix 5.

Summary

The total reduction in emissions from energy efficiency, low-carbon and renewable technologies are calculated as; 10,441 kg CO₂ per year, which equates to a reduction of 66.64% (% of TER).

The residual emissions are **5.226 tonnes**, which requires a carbon offset payment of **£14,894** (based on the carbon offset payment of £2,850 per tonne).

Appendix 1 – SAP Worksheets for the units using Gas Baseline

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-01			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT GF		
Property	Plot 1, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	85 B	DER	16.45	TER	17.77
Environmental	88 B	% DER<TER	7.43		
CO ₂ Emissions (t/year)	1.06	DFEE	43.35	TFEE	48.63
General Requirements Compliance	Pass	% DFEE<TFEE	10.86		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

Anderson Goddard Ltd
eco-survey.com

Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740 (61)
Total heat required for water heating calculated for each month												
Solar input	162.4661	142.4280	147.7662	129.9459	125.5200	109.5379	102.7082	116.1371	117.0081	134.8696	145.7751	157.7081 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
FGHRS	-44.6441	-35.4843	-31.6243	-22.1438	-13.2913	-7.0733	-6.5545	Solar input	(sum of months) = Sum(63)m =			0.0000 (63)
Output from w/h								-7.5213	-7.6112	-22.4265	-33.9444	-44.8899 eq. (G2)
	117.8220	106.9437	116.1418	107.8021	112.2287	102.4645	96.1537	108.6157	109.3970	112.4432	111.8307	112.8181 (64)
								Total per year (kWh/year) =	Sum(64)m =			1314.6612 (64)
Heat gains from water heating, kWh/month												
	53.0569	46.4874	48.1691	42.2750	40.7723	35.4893	33.1874	37.6525	37.9732	43.8811	47.5382	51.4748 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3533.4375 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	657.8049	494.4877	395.7688	209.0250	77.2451	0.0000	0.0000	0.0000	0.0000	207.1947	452.8201	675.1472	(98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)
Space heating fuel (main heating system)	733.3388	551.2683	441.2138	233.0268	86.1149	0.0000	0.0000	0.0000	0.0000	230.9863	504.8161	752.6724	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	117.8220	106.9437	116.1418	107.8021	112.2287	102.4645	96.1537	108.6157	109.3970	112.4432	111.8307	112.8181	(64)
Efficiency of water heater (217)m	89.2631	89.1890	89.0490	88.7273	88.0201	86.9000	86.9000	86.9000	86.9000	88.6947	89.1312	89.2881	(217)
Fuel for water heating, kWh/month	131.9941	119.9068	130.4246	121.4982	127.5034	117.9109	110.6487	124.9894	125.8883	126.7756	125.4674	126.3529	(219)
Water heating fuel used												1489.3604	(219)
Annual totals kWh/year													
Space heating fuel - main system												3533.4375	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												352.5010	(232)
Total delivered energy for all uses												5450.2989	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3533.4375	0.2160	763.2225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1489.3604	0.2160	321.7019 (264)
Space and water heating			1084.9244 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/year			1306.7974 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.4500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.4500	ZC1
Total Floor Area	TFA	79.4400	
Assumed number of occupants	N	2.4521	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2815	ZC2
CO2 emissions from cooking, equation (L16)		2.2388	ZC3
Total CO2 emissions		34.9703	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.9703	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1420 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3920 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	45.0999	48.0478	44.6744	44.2793	41.0275	42.3951	44.2793	44.6744	48.0478	48.3213	50.9589 (61)
Total heat required for water heating calculated for each month	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (64)
Heat gains from water heating, kWh/month	62.8781	55.1263	57.2626	50.6192	48.9236	42.9218	40.8677	45.8038	46.3174	52.9745	56.7942	61.2961 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	84.5136	82.0332	76.9659	70.3045	65.7576	59.6137	54.9296	61.5643	64.3298	71.2023	78.8808	82.3872	(72)
Total internal gains	385.5220	383.0749	368.9893	346.6747	324.0339	302.2036	288.4438	295.0452	306.8289	329.3547	355.1271	374.3199	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (77)
South			7.7200		46.7521		0.6300		0.7000		0.7700		110.3037 (78)
Southwest			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (79)
West			3.9900		19.6403		0.6300		0.7000		0.7700		23.9493 (80)
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705	(83)
Total gains	544.7381	653.0952	734.4389	791.3679	813.7018	784.3528	754.9625	728.7985	699.9418	626.7882	545.6366	510.6904	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175	
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812	
util living area	0.9964	0.9907	0.9769	0.9393	0.8520	0.6891	0.5176	0.5556	0.7857	0.9543	0.9918	0.9974 (86)	
MIT	19.8045	19.9972	20.2592	20.5671	20.8135	20.9540	20.9911	20.9873	20.9085	20.5822	20.1302	19.7703 (87)	
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498 (88)	
util rest of house	0.9952	0.9876	0.9691	0.9182	0.8016	0.5975	0.4015	0.4386	0.7047	0.9339	0.9886	0.9965 (89)	
MIT 2	18.3586	18.6402	19.0192	19.4591	19.7796	19.9386	19.9654	19.9654	19.8957	19.4895	18.8436	18.3155 (90)	
Living area fraction									fLA = Living area / (4) =			0.2942 (91)	
MIT	18.7839	19.0394	19.3840	19.7851	20.0837	20.2373	20.2671	20.2661	20.1937	19.8110	19.2221	18.7435 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7839	19.0394	19.3840	19.7851	20.0837	20.2373	20.2671	20.2661	20.1937	19.8110	19.2221	18.7435 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9933	0.9841	0.9637	0.9140	0.8084	0.6228	0.4359	0.4732	0.7244	0.9303	0.9854	0.9950 (94)
Useful gains	541.0738	642.6901	707.7750	723.2934	657.7864	488.4833	329.0572	344.8717	507.0574	583.1102	537.6945	508.1242 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1351.7507	1316.1394	1196.1948	998.3684	767.1833	510.3352	331.9823	349.2887	553.9507	842.8836	1114.4335	1343.5145 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	603.1436	452.5579	363.3844	198.0540	81.3913	0.0000	0.0000	0.0000	0.0000	193.2714	415.2521	621.5304 (98)
Space heating												2928.5850 (98)
Space heating per m2												36.8654 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3135.5300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	603.1436	452.5579	363.3844	198.0540	81.3913	0.0000	0.0000	0.0000	0.0000	193.2714	415.2521	621.5304 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	645.7640	484.5374	389.0625	212.0492	87.1427	0.0000	0.0000	0.0000	0.0000	206.9287	444.5954	665.4501 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (64)
Efficiency of water heater (217)m	87.6371	87.3126	86.7312	85.5376	83.4690	80.3000	80.3000	80.3000	80.3000	85.3564	87.0532	80.3000 (216)
Fuel for water heating, kWh/month	230.2119	202.7011	212.3111	190.9369	189.4421	173.4346	166.1636	185.2334	187.2791	200.6217	209.9853	87.7439 (217)
Water heating fuel used												224.5090 (219)
Annual totals kWh/year												2372.8299 (219)
Space heating fuel - main system												3135.5300 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												352.5010 (232)
Total delivered energy for all uses												5935.8609 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3135.5300	0.2160	677.2745 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2372.8299	0.2160	512.5313 (264)
Space and water heating			1189.8057 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/m2/year			1411.6788 (272)
Emissions per m2 for space and water heating			14.9774 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3030 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9774 * 1.00) + 2.3030 + 0.4900, rounded to 2 d.p.			17.7700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-02			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT GF		
Property	Plot 2, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	84 B	DER	17.90	TER	19.12
Environmental	87 B	% DER<TER	6.38		
CO ₂ Emissions (t/year)	1.06	DFEE	47.52	TFEE	53.03
General Requirements Compliance	Pass	% DFEE<TFEE	10.39		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss							(33) + (36) = 43.7911 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740 (61)
Total heat required for water heating calculated for each month												
Solar input	157.8219	138.3661	143.5747	126.2917	122.0137	106.5122	99.9045	112.9198	113.7524	131.0754	141.6334	153.2104 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
FGHRS	-42.7399	-35.7665	-33.4083	-23.9880	-14.8432	-6.8555	-6.3526	Solar input	(sum of months) =	Sum(63)m =		0.0000 (63)
Output from w/h								-7.2897	-7.3768	-24.4293	-33.5784	-42.5086 eq. (G2)
	115.0819	102.5996	110.1664	102.3036	107.1705	99.6567	93.5519	105.6301	106.3756	106.6461	108.0549	110.7019 (64)
								Total per year (kWh/year)	=	Sum(64)m =		1267.9393 (64)
Heat gains from water heating, kWh/month												
	51.5127	45.1368	46.7755	41.0599	39.6065	34.4833	32.2551	36.5827	36.8906	42.6195	46.1611	49.9794 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	69.2375	67.1679	62.8703	57.0277	53.2345	47.8934	43.3537	49.1703	51.2370	57.2842	64.1126	67.1766 (72)
Total internal gains	355.2092	353.1240	340.2555	319.5835	298.6757	278.5209	265.4374	271.2698	281.9073	302.7840	326.7269	344.6046 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
North				9.7300	10.6334	0.6300		0.7000	0.7700		31.6196 (74)	
West				1.7600	19.6403	0.6300		0.7000	0.7700		10.5641 (80)	
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	397.3929	434.2163	476.9685	534.1489	581.6816	578.6371	546.7809	498.3697	444.9437	399.2355	378.9059	379.6517 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	87.6276	87.9462	88.2607	89.7684	90.0563	91.4208	91.4208	91.6781	90.8904	90.0563	89.4759	88.8770
alpha	6.8418	6.8631	6.8840	6.9846	7.0038	7.0947	7.0947	7.1119	7.0594	7.0038	6.9651	6.9251
util living area	0.9999	0.9997	0.9990	0.9938	0.9591	0.8200	0.6369	0.7159	0.9514	0.9973	0.9997	0.9999 (86)
MIT	20.0472	20.1340	20.3049	20.5614	20.8077	20.9612	20.9944	20.9881	20.8710	20.5701	20.2731	20.0392 (87)
Th 2	19.9688	19.9721	19.9754	19.9908	19.9937	20.0072	20.0072	20.0097	20.0020	19.9937	19.9879	19.9817 (88)
util rest of house	0.9998	0.9996	0.9984	0.9898	0.9311	0.7246	0.4996	0.5761	0.9048	0.9950	0.9995	0.9999 (89)
MIT 2	18.6935	18.8231	19.0757	19.4607	19.8041	19.9850	20.0058	20.0061	19.8970	19.4774	19.0390	18.6918 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.2679 (91)
MIT	19.0561	19.1743	19.4050	19.7555	20.0729	20.2465	20.2706	20.2692	20.1579	19.7701	19.3696	19.0527 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0561	19.1743	19.4050	19.7555	20.0729	20.2465	20.2706	20.2692	20.1579	19.7701	19.3696	19.0527 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9997	0.9994	0.9979	0.9885	0.9339	0.7500	0.5371	0.6148	0.9142	0.9943	0.9993	0.9998 (94)
Useful gains	397.2801	433.9495	475.9844	527.9975	543.2044	433.9799	293.6842	306.3883	406.7490	396.9508	378.6479	379.5750 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1239.0062	1194.2055	1075.8027	889.7552	684.0777	454.4441	295.4178	310.5248	490.3987	749.2118	1008.9449	1229.5849 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	626.2442	510.8920	446.2648	260.4655	104.8098	0.0000	0.0000	0.0000	0.0000	262.0822	453.8139	632.4073 (98)
Space heating												3296.9798 (99)
Space heating per m2												44.7412 (99)
										(98) / (4) =		

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3675.5628 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.2442	510.8920	446.2648	260.4655	104.8098	0.0000	0.0000	0.0000	0.0000	262.0822	453.8139	632.4073	(98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)
Space heating fuel (main heating system)	698.1541	569.5564	497.5081	290.3741	116.8448	0.0000	0.0000	0.0000	0.0000	292.1764	505.9240	705.0249	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	115.0819	102.5996	110.1664	102.3036	107.1705	99.6567	93.5519	105.6301	106.3756	106.6461	108.0549	110.7019	(64)
Efficiency of water heater (217)m	89.2536	89.2192	89.1314	88.8923	88.2622	86.9000	86.9000	86.9000	86.9000	88.8718	89.1476	89.2715	(216)
Fuel for water heating, kWh/month	128.9382	114.9972	123.6000	115.0872	121.4228	114.6798	107.6547	121.5536	122.4116	119.9999	121.2090	124.0058	(219)
Water heating fuel used												1435.5598	(219)
Annual totals kWh/year													
Space heating fuel - main system												3675.5628	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												339.7119	(232)
Total delivered energy for all uses												5525.8345	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3675.5628	0.2160	793.9216 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1435.5598	0.2160	310.0809 (264)
Space and water heating			1104.0025 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/year			1319.2379 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9000 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.9000	ZC1
Total Floor Area	TFA	73.6900	
Assumed number of occupants	N	2.3323	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5455	ZC2
CO2 emissions from cooking, equation (L16)		2.3745	ZC3
Total CO2 emissions		36.8200	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.8200	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss						(33) + (36) =	42.9985 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.2204	43.7109	46.5680	43.2985	42.9156	39.7639	41.0894	42.9156	43.2985	46.5680	46.8331	50.2204 (61)
Total heat required for water heating calculated for each month	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (64)
Heat gains from water heating, kWh/month	61.1493	53.4285	55.4990	49.0602	47.4169	41.5999	39.6090	44.3931	44.8909	51.3430	55.0450	59.6160 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	82.1899	79.5067	74.5954	68.1392	63.7323	57.7776	53.2379	59.6682	62.3485	69.0094	76.4514	80.1290 (72)
Total internal gains	368.1616	365.4628	351.9806	330.6950	309.1736	288.4051	275.3216	281.7676	293.0188	314.5091	339.0657	357.5571 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)	
West					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)	
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	410.3453	446.5550	488.6936	545.2604	592.1795	588.5213	556.6651	508.8675	456.0552	410.9607	391.2447	392.6041 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337
util living area	0.9986	0.9975	0.9939	0.9781	0.9188	0.7704	0.6028	0.6730	0.9067	0.9874	0.9973	0.9989 (86)
MIT	19.7776	19.8906	20.1134	20.4404	20.7453	20.9344	20.9858	20.9754	20.8287	20.4537	20.0669	19.7617 (87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061 (88)
util rest of house	0.9981	0.9967	0.9916	0.9690	0.8842	0.6846	0.4795	0.5489	0.8528	0.9808	0.9962	0.9985 (89)
MIT 2	18.3591	18.5261	18.8529	19.3333	19.7521	19.9799	20.0207	20.0172	19.8712	19.3586	18.7932	18.3433 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	18.7391	18.8916	19.1905	19.6299	20.0182	20.2356	20.2792	20.2739	20.1277	19.6519	19.1344	18.7232 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7391	18.8916	19.1905	19.6299	20.0182	20.2356	20.2792	20.2739	20.1277	19.6519	19.1344	18.7232 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9972	0.9953	0.9890	0.9644	0.8843	0.7047	0.5128	0.5822	0.8598	0.9773	0.9948	0.9978 (94)
Useful gains	409.2110	444.4432	483.3249	525.8581	523.6531	414.7564	285.4516	296.2630	392.1292	401.6348	389.2116	391.7444 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1176.9571	1137.1288	1028.4066	857.6830	663.1898	443.8987	289.8012	304.4462	477.0170	721.6884	964.4999	1170.3103 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	571.2031	465.4848	405.5408	238.9140	103.8153	0.0000	0.0000	0.0000	0.0000	238.1199	414.2076	579.2531 (98)
Space heating												3016.5385 (98)
Space heating per m2										(98) / (4) =		40.9355 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3229.6986	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	571.2031 465.4848 405.5408 238.9140 103.8153 0.0000 0.0000 0.0000 0.0000 238.1199 414.2076 579.2531	(98)
Space heating efficiency (main heating system 1)	93.4000 93.4000 93.4000 93.4000 93.4000 0.0000 0.0000 0.0000 0.0000 93.4000 93.4000 93.4000	(210)
Space heating fuel (main heating system)	611.5665 498.3777 434.1979 255.7965 111.1512 0.0000 0.0000 0.0000 0.0000 254.9464 443.4771 620.1853	(211)
Water heating requirement	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(215)
Water heating		
Water heating requirement	196.3683 171.5328 178.4687 158.2928 153.2553 134.9787 129.3199 144.1614 145.7535 165.9694 177.1691 191.7568	(64)
Efficiency of water heater	87.5818 87.4385 87.0539 86.0850 84.0943 80.3000 80.3000 80.3000 80.3000 85.9593 87.1173 87.6579	(216)
(217)m	87.5818 87.4385 87.0539 86.0850 84.0943 80.3000 80.3000 80.3000 80.3000 85.9593 87.1173 87.6579	(217)
Fuel for water heating, kWh/month	224.2113 196.1752 205.0094 183.8796 182.2423 168.0931 161.0460 179.5285 181.5112 193.0790 203.3685 218.7560	(219)
Water heating fuel used		2296.9000 (219)
Annual totals kWh/year		
Space heating fuel - main system		3229.6986 (211)
Space heating fuel - secondary		0.0000 (215)
Electricity for pumps and fans:		
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		75.0000 (231)
Electricity for lighting (calculated in Appendix L)		339.7119 (232)
Total delivered energy for all uses		5941.3105 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3229.6986	0.2160	697.6149 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2296.9000	0.2160	496.1304 (264)
Space and water heating			1193.7453 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1408.9808 (272)
Emissions per m2 for space and water heating			16.1996 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1996 * 1.00) + 2.3926 + 0.5282, rounded to 2 d.p.			19.1200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-03			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT GF		
Property	Plot 3, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	84 B	DER	18.39	TER	19.65
Environmental	88 B	% DER<TER	6.39		
CO ₂ Emissions (t/year)	0.88	DFEE	45.70	TFEE	50.08
General Requirements Compliance	Pass	% DFEE<TFEE	8.75		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4788	0.4694	0.4600	0.4131	0.4037	0.3568	0.3568	0.3474	0.3755	0.4037	0.4225	0.4413 (22b)
Effective ac	0.6146	0.6102	0.6058	0.5853	0.5815	0.5636	0.5636	0.5603	0.5705	0.5815	0.5892	0.5974 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1200	7.0560	75.0000	4410.0000 (28a)
Main Type 3	19.0300	8.4600	10.5700	0.1700	1.7969	110.0000	1162.7000 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.2643			(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			58.8000			30.0000	1764.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18673.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5689 (35)
Thermal bridges (User defined value 0.078 * total exposed area)							7.5551 (36)
Total fabric heat loss						(33) + (36) =	33.8194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.7238	31.4941	31.2689	30.2111	30.0132	29.0920	29.0920	28.9214	29.4468	30.0132	30.4136	30.8321 (38)
Heat transfer coeff	65.5432	65.3135	65.0883	64.0306	63.8327	62.9114	62.9114	62.7408	63.2663	63.8327	64.2330	64.6516 (39)
Average = Sum(39)m / 12 =												64.0296 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1147	1.1108	1.1069	1.0890	1.0856	1.0699	1.0699	1.0670	1.0760	1.0856	1.0924	1.0995 (40)
HLP (average)												1.0889 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9475 (42)
Average daily hot water use (litres/day)	80.4534 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740	11.2974	11.6740	11.2974	11.6740 (61)	
Total heat required for water heating calculated for each month	142.9150	125.3285	130.1210	114.5624	110.7592	96.8004	90.9051	102.5928	103.3021	118.8966	128.3393	138.7739 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
FGHRS	-34.5460	-29.3193	-27.7763	-20.7870	-12.9495	-6.1562	-5.7046	Solar input (sum of months) =	Sum(63)m =	-6.5462	-20.8683	-27.6188	-34.3267 eq. (G2)
Output from w/h	108.3690	96.0092	102.3447	93.7754	97.8097	90.6442	85.2004	96.0467	96.6778	98.0283	100.7205	104.4472 (64)	
								Total per year (kWh/year) =	Sum(64)m =			1170.0730 (64)	
Heat gains from water heating, kWh/month	46.5561	40.8018	42.3021	37.1600	35.8643	31.2541	29.2628	33.1490	33.4159	38.5700	41.7408	45.1792 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	(71)
Water heating gains (Table 5)	62.5754	60.7170	56.8577	51.6111	48.2047	43.4085	39.3318	44.5551	46.4110	51.8414	57.9733	60.7247	(72)
Total internal gains	303.8536	301.9521	290.9702	273.4300	255.8531	238.8064	227.6818	232.9483	241.9267	259.6507	279.9531	294.9550	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

North				8.4600	10.6334	0.6300		0.7000		0.7700			27.4925 (74)

Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191	(83)
Total gains	331.3461	354.4916	380.2477	416.8326	449.0296	445.6075	420.7570	386.1288	349.2673	322.1922	313.8686	317.8741	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.1380	79.4163	79.6911	81.0075	81.2587	82.4486	82.4486	82.6728	81.9862	81.2587	80.7522	80.2294	
alpha	6.2759	6.2944	6.3127	6.4005	6.4172	6.4966	6.4966	6.5115	6.4657	6.4172	6.3835	6.3486	
util living area	0.9996	0.9993	0.9981	0.9912	0.9535	0.8189	0.6424	0.7155	0.9417	0.9950	0.9992	0.9997	(86)
MIT	19.9901	20.0769	20.2526	20.5197	20.7801	20.9497	20.9913	20.9836	20.8568	20.5438	20.2311	19.9811	(87)
Th 2	19.9889	19.9920	19.9952	20.0099	20.0126	20.0255	20.0255	20.0279	20.0205	20.0126	20.0070	20.0012	(88)
util rest of house	0.9994	0.9990	0.9971	0.9862	0.9258	0.7293	0.5089	0.5816	0.8943	0.9914	0.9987	0.9996	(89)
MIT 2	18.6380	18.7674	19.0266	19.4257	19.7890	19.9936	20.0228	20.0219	19.8993	19.4649	19.0046	18.6342	(90)
Living area fraction									fLA = Living area / (4) =			0.3240	(91)
MIT	19.0760	19.1917	19.4238	19.7801	20.1101	20.3034	20.3366	20.3335	20.2095	19.8145	19.4019	19.0706	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0760	19.1917	19.4238	19.7801	20.1101	20.3034	20.3366	20.3335	20.2095	19.8145	19.4019	19.0706	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	331.0860	353.9952	378.8567	410.4359	417.2307	337.5012	232.6802	241.7871	316.3327	319.0945	313.3466	317.6851	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	968.4677	933.4395	841.1898	696.6612	536.8390	358.8060	235.0734	246.7886	386.5239	588.1833	790.1907	961.4064	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	474.2120	389.3866	343.9758	206.0822	88.9886	0.0000	0.0000	0.0000	0.0000	200.2021	343.3278	478.9286	(98)
Space heating												2525.1037	(98)
Space heating per m2												(98) / (4) =	42.9439 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2815.0543 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	474.2120	389.3866	343.9758	206.0822	88.9886	0.0000	0.0000	0.0000	0.0000	200.2021	343.3278	478.9286	(98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)
Space heating fuel (main heating system)	528.6644	434.0988	383.4736	229.7461	99.2069	0.0000	0.0000	0.0000	0.0000	223.1908	382.7511	533.9227	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	108.3690	96.0092	102.3447	93.7754	97.8097	90.6442	85.2004	96.0467	96.6778	98.0283	100.7205	104.4472	(64)
Efficiency of water heater (217)m	89.1656	89.1319	89.0421	88.8052	88.2118	86.9000	86.9000	86.9000	86.9000	88.7599	89.0492	86.9000	(216)
Fuel for water heating, kWh/month	121.5368	107.7158	114.9396	105.5968	110.8806	104.3086	98.0442	110.5255	111.2518	110.4421	113.1065	117.1123	(219)
Water heating fuel used												1325.4607	(219)
Annual totals kWh/year													
Space heating fuel - main system												2815.0543	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												285.3006	(232)
Total delivered energy for all uses												4500.8155	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2815.0543	0.2160	608.0517 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1325.4607	0.2160	286.2995 (264)
Space and water heating			894.3512 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	285.3006	0.5190	148.0710 (268)
Total CO2, kg/year			1081.3472 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.3900 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.3900	ZC1
Total Floor Area	TFA	58.8000	
Assumed number of occupants	N	1.9475	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1234	ZC2
CO2 emissions from cooking, equation (L16)		2.8187	ZC3
Total CO2 emissions		38.3321	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		38.3321	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1279 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3779 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3212 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3613	0.3774 (22b)
Effective ac	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1300	7.6440		(28a)
Main Type 3	19.0300	8.4600	10.5700	0.1800	1.9026		(29a)
Corridor	19.0300	1.9500	17.0800	0.1800	3.0744		(29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.7869		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3601 (36)
Total fabric heat loss						(33) + (36) =	32.1470 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1353	29.9673	29.8025	29.0288	28.8840	28.2101	28.2101	28.0853	28.4697	28.8840	29.1769	29.4830 (38)
Heat transfer coeff	62.2823	62.1143	61.9495	61.1758	61.0310	60.3571	60.3571	60.2323	60.6167	61.0310	61.3239	61.6301 (39)
Average = Sum(39)m / 12 =												61.1751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0592	1.0564	1.0536	1.0404	1.0379	1.0265	1.0265	1.0244	1.0309	1.0379	1.0429	1.0481 (40)
HLP (average)												1.0404 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	45.0980	39.2524	41.8181	38.8821	38.5383	35.7081	36.8983	38.5383	38.8821	41.8181	42.0562	45.0980 (61)
Total heat required for water heating calculated for each month	176.3390	154.0366	160.2651	142.1471	137.6235	121.2111	116.1294	129.4571	130.8868	149.0407	159.0980	172.1979 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	176.3390	154.0366	160.2651	142.1471	137.6235	121.2111	116.1294	129.4571	130.8868	149.0407	159.0980	172.1979 (64)
Heat gains from water heating, kWh/month	54.9121	47.9789	49.8382	44.0561	42.5804	37.3568	35.5689	39.8651	40.3121	46.1061	49.4305	53.5352 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004 (71)
Water heating gains (Table 5)	73.8066	71.3971	66.9868	61.1891	57.2317	51.8844	47.8077	53.5821	55.9890	61.9705	68.6534	71.9559 (72)
Total internal gains	315.0848	312.6322	301.0993	283.0080	264.8801	247.2823	236.1577	241.9752	251.5048	269.7798	290.6333	306.1862 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			

North				8.4600	10.6334	0.6300	0.7000	0.7700	27.4925 (74)			

Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191 (83)
Total gains	342.5773	365.1717	390.3768	426.4106	458.0566	454.0834	429.2330	395.1558	358.8453	332.3213	324.5488	329.1053 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.5617	65.7391	65.9139	66.7475	66.9059	67.6529	67.6529	67.7931	67.3632	66.9059	66.5863	66.2556
alpha	5.3708	5.3826	5.3943	5.4498	5.4604	5.5102	5.5102	5.5195	5.4909	5.4604	5.4391	5.4170
util living area	0.9983	0.9972	0.9937	0.9784	0.9202	0.7707	0.6012	0.6684	0.9028	0.9859	0.9968	0.9986 (86)
MIT	19.8662	19.9667	20.1703	20.4735	20.7618	20.9406	20.9877	20.9788	20.8461	20.4993	20.1384	19.8499 (87)
Th 2	20.0343	20.0366	20.0389	20.0498	20.0518	20.0613	20.0613	20.0631	20.0577	20.0518	20.0477	20.0434 (88)
util rest of house	0.9977	0.9962	0.9913	0.9696	0.8866	0.6870	0.4819	0.5482	0.8486	0.9785	0.9954	0.9982 (89)
MIT 2	18.5163	18.6648	18.9632	19.4085	19.8044	20.0191	20.0564	20.0535	19.9223	19.4508	18.9241	18.4990 (90)
Living area fraction	18.9536	19.0866	19.3543	19.7535	20.1146	20.3176	20.3581	20.3533	19.9223	19.4508	18.9241	0.3240 (91)
MIT	18.9536	19.0866	19.3543	19.7535	20.1146	20.3176	20.3581	20.3533	20.2216	19.7905	19.3175	18.9367 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9536	19.0866	19.3543	19.7535	20.1146	20.3176	20.3581	20.3533	20.2216	19.7905	19.3175	18.9367 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9968	0.9949	0.9890	0.9660	0.8892	0.7117	0.5209	0.5874	0.8597	0.9758	0.9940	0.9974 (94)
Ext temp.	341.4664	363.2992	386.0779	411.9216	407.3022	323.1700	223.5960	232.1167	308.5151	324.2784	322.5966	328.2455 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	912.6607	881.1907	796.3172	663.9742	513.5501	345.0993	226.8308	238.1165	371.0695	560.9057	749.2260	908.2219 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	424.9686	348.0231	305.2181	181.4779	79.0484	0.0000	0.0000	0.0000	0.0000	176.0507	307.1732	431.5024 (98)
												2253.4624 (98)
												38.3242 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2412.7006 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	424.9686	348.0231	305.2181	181.4779	79.0484	0.0000	0.0000	0.0000	0.0000	176.0507	307.1732	431.5024	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	454.9985	372.6157	326.7860	194.3018	84.6343	0.0000	0.0000	0.0000	0.0000	188.4911	328.8792	461.9940	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	176.3390	154.0366	160.2651	142.1471	137.6235	121.2111	116.1294	129.4571	130.8868	149.0407	159.0980	172.1979	(64)
Efficiency of water heater	87.1842	87.0411	86.6477	85.6672	83.7122	80.3000	80.3000	80.3000	80.3000	85.4714	86.6799	80.3000	(216)
Fuel for water heating, kWh/month	202.2603	176.9700	184.9618	165.9294	164.4008	150.9478	144.6195	161.2168	162.9973	174.3750	183.5466	197.3183	(219)
Water heating fuel used												2069.5436	(219)
Annual totals kWh/year													
Space heating fuel - main system												2412.7006	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												285.3006	(232)
Total delivered energy for all uses												4842.5448	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2412.7006	0.2160	521.1433 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2069.5436	0.2160	447.0214 (264)
Space and water heating			968.1648 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	285.3006	0.5190	148.0710 (268)
Total CO2, kg/m2/year			1155.1608 (272)
Emissions per m2 for space and water heating			16.4654 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5182 (272b)
Emissions per m2 for pumps and fans			0.6620 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4654 * 1.00) + 2.5182 + 0.6620, rounded to 2 d.p.			19.6500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-04			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT GF		
Property	Plot 4, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	84 B	DER	17.90	TER	19.12
Environmental	87 B	% DER<TER	6.38		
CO ₂ Emissions (t/year)	1.06	DFEE	47.52	TFEE	53.03
General Requirements Compliance	Pass	% DFEE<TFEE	10.39		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss						(33) + (36) =	43.7911 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740 (61)
Total heat required for water heating calculated for each month												
Solar input	157.8219	138.3661	143.5747	126.2917	122.0137	106.5122	99.9045	112.9198	113.7524	131.0754	141.6334	153.2104 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
FGHRS	-42.7399	-35.7665	-33.4083	-23.9880	-14.8432	-6.8555	-6.3526	Solar input	(sum of months) =	Sum(63)m =		0.0000 (63)
Output from w/h								-7.2897	-7.3768	-24.4293	-33.5784	-42.5086 eq. (G2)
	115.0819	102.5996	110.1664	102.3036	107.1705	99.6567	93.5519	105.6301	106.3756	106.6461	108.0549	110.7019 (64)
								Total per year (kWh/year)	=	Sum(64)m =		1267.9393 (64)
Heat gains from water heating, kWh/month												
	51.5127	45.1368	46.7755	41.0599	39.6065	34.4833	32.2551	36.5827	36.8906	42.6195	46.1611	49.9794 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	69.2375	67.1679	62.8703	57.0277	53.2345	47.8934	43.3537	49.1703	51.2370	57.2842	64.1126	67.1766 (72)
Total internal gains	355.2092	353.1240	340.2555	319.5835	298.6757	278.5209	265.4374	271.2698	281.9073	302.7840	326.7269	344.6046 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
North				9.7300	10.6334	0.6300		0.7000	0.7700		31.6196 (74)	
West				1.7600	19.6403	0.6300		0.7000	0.7700		10.5641 (80)	
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	397.3929	434.2163	476.9685	534.1489	581.6816	578.6371	546.7809	498.3697	444.9437	399.2355	378.9059	379.6517 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	87.6276	87.9462	88.2607	89.7684	90.0563	91.4208	91.4208	91.6781	90.8904	90.0563	89.4759	88.8770
alpha	6.8418	6.8631	6.8840	6.9846	7.0038	7.0947	7.0947	7.1119	7.0594	7.0038	6.9651	6.9251
util living area	0.9999	0.9997	0.9990	0.9938	0.9591	0.8200	0.6369	0.7159	0.9514	0.9973	0.9997	0.9999 (86)
MIT	20.0472	20.1340	20.3049	20.5614	20.8077	20.9612	20.9944	20.9881	20.8710	20.5701	20.2731	20.0392 (87)
Th 2	19.9688	19.9721	19.9754	19.9908	19.9937	20.0072	20.0072	20.0097	20.0020	19.9937	19.9879	19.9817 (88)
util rest of house	0.9998	0.9996	0.9984	0.9898	0.9311	0.7246	0.4996	0.5761	0.9048	0.9950	0.9995	0.9999 (89)
MIT 2	18.6935	18.8231	19.0757	19.4607	19.8041	19.9850	20.0058	20.0061	19.8970	19.4774	19.0390	18.6918 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.2679 (91)
MIT	19.0561	19.1743	19.4050	19.7555	20.0729	20.2465	20.2706	20.2692	20.1579	19.7701	19.3696	19.0527 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0561	19.1743	19.4050	19.7555	20.0729	20.2465	20.2706	20.2692	20.1579	19.7701	19.3696	19.0527 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9997	0.9994	0.9979	0.9885	0.9339	0.7500	0.5371	0.6148	0.9142	0.9943	0.9993	0.9998 (94)
Useful gains	397.2801	433.9495	475.9844	527.9975	543.2044	433.9799	293.6842	306.3883	406.7490	396.9508	378.6479	379.5750 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1239.0062	1194.2055	1075.8027	889.7552	684.0777	454.4441	295.4178	310.5248	490.3987	749.2118	1008.9449	1229.5849 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	626.2442	510.8920	446.2648	260.4655	104.8098	0.0000	0.0000	0.0000	0.0000	262.0822	453.8139	632.4073 (98)
Space heating												3296.9798 (99)
Space heating per m2											(98) / (4) =	44.7412 (99)

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3675.5628 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.2442	510.8920	446.2648	260.4655	104.8098	0.0000	0.0000	0.0000	0.0000	262.0822	453.8139	632.4073	(98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)
Space heating fuel (main heating system)	698.1541	569.5564	497.5081	290.3741	116.8448	0.0000	0.0000	0.0000	0.0000	292.1764	505.9240	705.0249	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	115.0819	102.5996	110.1664	102.3036	107.1705	99.6567	93.5519	105.6301	106.3756	106.6461	108.0549	110.7019	(64)
Efficiency of water heater (217)m	89.2536	89.2192	89.1314	88.8923	88.2622	86.9000	86.9000	86.9000	86.9000	88.8718	89.1476	89.2715	(216)
Fuel for water heating, kWh/month	128.9382	114.9972	123.6000	115.0872	121.4228	114.6798	107.6547	121.5536	122.4116	119.9999	121.2090	124.0058	(219)
Water heating fuel used												1435.5598	(219)
Annual totals kWh/year													
Space heating fuel - main system												3675.5628	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												339.7119	(232)
Total delivered energy for all uses												5525.8345	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3675.5628	0.2160	793.9216 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1435.5598	0.2160	310.0809 (264)
Space and water heating			1104.0025 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/year			1319.2379 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9000 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.9000	ZC1
Total Floor Area	TFA	73.6900	
Assumed number of occupants	N	2.3323	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5455	ZC2
CO2 emissions from cooking, equation (L16)		2.3745	ZC3
Total CO2 emissions		36.8200	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.8200	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss						(33) + (36) =	42.9985 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.2204	43.7109	46.5680	43.2985	42.9156	39.7639	41.0894	42.9156	43.2985	46.5680	46.8331	50.2204 (61)
Total heat required for water heating calculated for each month	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (64)
Heat gains from water heating, kWh/month	61.1493	53.4285	55.4990	49.0602	47.4169	41.5999	39.6090	44.3931	44.8909	51.3430	55.0450	59.6160 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)	82.1899	79.5067	74.5954	68.1392	63.7323	57.7776	53.2379	59.6682	62.3485	69.0094	76.4514	80.1290	(72)
Total internal gains	368.1616	365.4628	351.9806	330.6950	309.1736	288.4051	275.3216	281.7676	293.0188	314.5091	339.0657	357.5571	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196	
West					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)	
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	410.3453	446.5550	488.6936	545.2604	592.1795	588.5213	556.6651	508.8675	456.0552	410.9607	391.2447	392.6041 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051	
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337	
util living area	0.9986	0.9975	0.9939	0.9781	0.9188	0.7704	0.6028	0.6730	0.9067	0.9874	0.9973	0.9989	(86)
MIT	19.7776	19.8906	20.1134	20.4404	20.7453	20.9344	20.9858	20.9754	20.8287	20.4537	20.0669	19.7617	(87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061	(88)
util rest of house	0.9981	0.9967	0.9916	0.9690	0.8842	0.6846	0.4795	0.5489	0.8528	0.9808	0.9962	0.9985	(89)
MIT 2	18.3591	18.5261	18.8529	19.3333	19.7521	19.9799	20.0207	20.0172	19.8712	19.3586	18.7932	18.3433	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	18.7391	18.8916	19.1905	19.6299	20.0182	20.2356	20.2792	20.2739	20.1277	19.6519	19.1344	18.7232	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7391	18.8916	19.1905	19.6299	20.0182	20.2356	20.2792	20.2739	20.1277	19.6519	19.1344	18.7232	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	409.2110	444.4432	483.3249	525.8581	523.6531	414.7564	285.4516	296.2630	392.1292	401.6348	389.2116	391.7444	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1176.9571	1137.1288	1028.4066	857.6830	663.1898	443.8987	289.8012	304.4462	477.0170	721.6884	964.4999	1170.3103	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	571.2031	465.4848	405.5408	238.9140	103.8153	0.0000	0.0000	0.0000	0.0000	238.1199	414.2076	579.2531	(98)
Space heating												3016.5385	(98)
Space heating per m2										(98) / (4) =		40.9355	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3229.6986	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	571.2031 465.4848 405.5408 238.9140 103.8153 0.0000 0.0000 0.0000 0.0000 238.1199 414.2076 579.2531	(98)
Space heating efficiency (main heating system 1)	93.4000 93.4000 93.4000 93.4000 93.4000 0.0000 0.0000 0.0000 0.0000 93.4000 93.4000 93.4000	(210)
Space heating fuel (main heating system)	611.5665 498.3777 434.1979 255.7965 111.1512 0.0000 0.0000 0.0000 0.0000 254.9464 443.4771 620.1853	(211)
Water heating requirement	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(215)
Water heating		
Water heating requirement	196.3683 171.5328 178.4687 158.2928 153.2553 134.9787 129.3199 144.1614 145.7535 165.9694 177.1691 191.7568	(64)
Efficiency of water heater	87.5818 87.4385 87.0539 86.0850 84.0943 80.3000 80.3000 80.3000 80.3000 85.9593 87.1173 87.6579	(216)
(217)m	87.5818 87.4385 87.0539 86.0850 84.0943 80.3000 80.3000 80.3000 80.3000 85.9593 87.1173 87.6579	(217)
Fuel for water heating, kWh/month	224.2113 196.1752 205.0094 183.8796 182.2423 168.0931 161.0460 179.5285 181.5112 193.0790 203.3685 218.7560	(219)
Water heating fuel used		2296.9000 (219)
Annual totals kWh/year		
Space heating fuel - main system		3229.6986 (211)
Space heating fuel - secondary		0.0000 (215)
Electricity for pumps and fans:		
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		75.0000 (231)
Electricity for lighting (calculated in Appendix L)		339.7119 (232)
Total delivered energy for all uses		5941.3105 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3229.6986	0.2160	697.6149 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2296.9000	0.2160	496.1304 (264)
Space and water heating			1193.7453 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1408.9808 (272)
Emissions per m2 for space and water heating			16.1996 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1996 * 1.00) + 2.3926 + 0.5282, rounded to 2 d.p.			19.1200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-05			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT GF		
Property	Plot 5, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	85 B	DER	16.45	TER	17.77
Environmental	88 B	% DER<TER	7.43		
CO ₂ Emissions (t/year)	1.06	DFEE	43.35	TFEE	48.63
General Requirements Compliance	Pass	% DFEE<TFEE	10.86		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	42.8758			(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740 (61)
Total heat required for water heating calculated for each month												
Solar input	162.4661	142.4280	147.7662	129.9459	125.5200	109.5379	102.7082	116.1371	117.0081	134.8696	145.7751	157.7081 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
FGHRS	-44.6441	-35.4843	-31.6243	-22.1438	-13.2913	-7.0733	-6.5545	Solar input	(sum of months) = Sum(63)m =			0.0000 (63)
Output from w/h								-7.5213	-7.6112	-22.4265	-33.9444	-44.8899 eq. (G2)
	117.8220	106.9437	116.1418	107.8021	112.2287	102.4645	96.1537	108.6157	109.3970	112.4432	111.8307	112.8181 (64)
								Total per year (kWh/year) =	Sum(64)m =			1314.6612 (64)
Heat gains from water heating, kWh/month												
	53.0569	46.4874	48.1691	42.2750	40.7723	35.4893	33.1874	37.6525	37.9732	43.8811	47.5382	51.4748 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3533.4375 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	657.8049	494.4877	395.7688	209.0250	77.2451	0.0000	0.0000	0.0000	0.0000	207.1947	452.8201	675.1472	(98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)
Space heating fuel (main heating system)	733.3388	551.2683	441.2138	233.0268	86.1149	0.0000	0.0000	0.0000	0.0000	230.9863	504.8161	752.6724	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	117.8220	106.9437	116.1418	107.8021	112.2287	102.4645	96.1537	108.6157	109.3970	112.4432	111.8307	112.8181	(64)
Efficiency of water heater (217)m	89.2631	89.1890	89.0490	88.7273	88.0201	86.9000	86.9000	86.9000	86.9000	88.6947	89.1312	89.2881	(217)
Fuel for water heating, kWh/month	131.9941	119.9068	130.4246	121.4982	127.5034	117.9109	110.6487	124.9894	125.8883	126.7756	125.4674	126.3529	(219)
Water heating fuel used												1489.3604	(219)
Annual totals kWh/year													
Space heating fuel - main system												3533.4375	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												352.5010	(232)
Total delivered energy for all uses												5450.2989	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3533.4375	0.2160	763.2225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1489.3604	0.2160	321.7019 (264)
Space and water heating			1084.9244 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/year			1306.7974 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.4500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.4500	ZC1
Total Floor Area	TFA	79.4400	
Assumed number of occupants	N	2.4521	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2815	ZC2
CO2 emissions from cooking, equation (L16)		2.2388	ZC3
Total CO2 emissions		34.9703	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.9703	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1420 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3920 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	45.0999	48.0478	44.6744	44.2793	41.0275	42.3951	44.2793	44.6744	48.0478	48.3213	50.9589 (61)
Total heat required for water heating calculated for each month	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (64)
Heat gains from water heating, kWh/month	62.8781	55.1263	57.2626	50.6192	48.9236	42.9218	40.8677	45.8038	46.3174	52.9745	56.7942	61.2961 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	84.5136	82.0332	76.9659	70.3045	65.7576	59.6137	54.9296	61.5643	64.3298	71.2023	78.8808	82.3872	(72)
Total internal gains	385.5220	383.0749	368.9893	346.6747	324.0339	302.2036	288.4438	295.0452	306.8289	329.3547	355.1271	374.3199	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					3.9900	19.6403	0.6300	0.7000	0.7700		23.9493 (76)	
Southeast					1.1100	36.7938	0.6300	0.7000	0.7700		12.4816 (77)	
South					7.7200	46.7521	0.6300	0.7000	0.7700		110.3037 (78)	
Southwest					1.1100	36.7938	0.6300	0.7000	0.7700		12.4816 (79)	
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705 (83)
Total gains	544.7381	653.0952	734.4389	791.3679	813.7018	784.3528	754.9625	728.7985	699.9418	626.7882	545.6366	510.6904 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175	
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812	
util living area	0.9964	0.9907	0.9769	0.9393	0.8520	0.6891	0.5176	0.5556	0.7857	0.9543	0.9918	0.9974	(86)
MIT	19.8045	19.9972	20.2592	20.5671	20.8135	20.9540	20.9911	20.9873	20.9085	20.5822	20.1302	19.7703	(87)
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498	(88)
util rest of house	0.9952	0.9876	0.9691	0.9182	0.8016	0.5975	0.4015	0.4386	0.7047	0.9339	0.9886	0.9965	(89)
MIT 2	18.3586	18.6402	19.0192	19.4591	19.7796	19.9386	19.9654	19.9654	19.8957	19.4895	18.8436	18.3155	(90)
Living area fraction	18.7839	19.0394	19.3840	19.7851	20.0837	20.2373	20.2671	20.2661	20.1937	19.8110	19.2221	18.7435	(91)
MIT	18.7839	19.0394	19.3840	19.7851	20.0837	20.2373	20.2671	20.2661	20.1937	19.8110	19.2221	18.7435	(92)
Temperature adjustment	18.7839	19.0394	19.3840	19.7851	20.0837	20.2373	20.2671	20.2661	20.1937	19.8110	19.2221	18.7435	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9933	0.9841	0.9637	0.9140	0.8084	0.6228	0.4359	0.4732	0.7244	0.9303	0.9854	0.9950	(94)
Ext temp.	541.0738	642.6901	707.7750	723.2934	657.7864	488.4833	329.0572	344.8717	507.0574	583.1102	537.6945	508.1242	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1351.7507	1316.1394	1196.1948	998.3684	767.1833	510.3352	331.9823	349.2887	553.9507	842.8836	1114.4335	1343.5145	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	603.1436	452.5579	363.3844	198.0540	81.3913	0.0000	0.0000	0.0000	0.0000	193.2714	415.2521	621.5304	(98)
Space heating per m2												2928.5850	(98)
												36.8654	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3135.5300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	603.1436	452.5579	363.3844	198.0540	81.3913	0.0000	0.0000	0.0000	0.0000	193.2714	415.2521	621.5304	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	645.7640	484.5374	389.0625	212.0492	87.1427	0.0000	0.0000	0.0000	0.0000	206.9287	444.5954	665.4501	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930	(64)
Efficiency of water heater (217)m	87.6371	87.3126	86.7312	85.5376	83.4690	80.3000	80.3000	80.3000	80.3000	85.3564	87.0532	80.3000	(216)
Fuel for water heating, kWh/month	230.2119	202.7011	212.3111	190.9369	189.4421	173.4346	166.1636	185.2334	187.2791	200.6217	209.9853	224.5090	(219)
Water heating fuel used												2372.8299	(219)
Annual totals kWh/year													
Space heating fuel - main system												3135.5300	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												352.5010	(232)
Total delivered energy for all uses												5935.8609	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3135.5300	0.2160	677.2745 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2372.8299	0.2160	512.5313 (264)
Space and water heating			1189.8057 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/m2/year			1411.6788 (272)
Emissions per m2 for space and water heating			14.9774 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3030 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9774 * 1.00) + 2.3030 + 0.4900, rounded to 2 d.p.			17.7700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-06			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT Mid		
Property	Plot 6, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	85 B	DER	16.25	TER	17.13
Environmental	88 B	% DER<TER	5.13		
CO ₂ Emissions (t/year)	1.07	DFEE	42.60	TFEE	44.96
General Requirements Compliance	Pass	% DFEE<TFEE	5.25		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum(A, m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area)		16.1445 (36)
Total fabric heat loss	(33) + (36) =	51.2907 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	94.0596	93.7527	93.4519	92.0391	91.7748	90.5443	90.5443	90.3164	91.0182	91.7748	92.3095	92.8686 (39)
Average = Sum(39)m / 12 =												92.0379 (39)
HLP	1.1840	1.1802	1.1764	1.1586	1.1553	1.1398	1.1398	1.1369	1.1457	1.1553	1.1620	1.1690 (40)
HLP (average)												1.1586 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740	11.2974	11.6740	11.2974	11.6740 (61)
Total heat required for water heating calculated for each month												
	162.4661	142.4280	147.7662	129.9459	125.5200	109.5379	102.7082	116.1371	117.0081	134.8696	145.7751	157.7081 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
	Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
FGHRS	-43.0929	-34.6359	-31.3832	-22.6424	-14.6332	-7.0733	-6.5545	-7.5213	-7.6112	-22.6485	-33.0777	-43.2517 eq. (G2)
Output from w/h	119.3731	107.7920	116.3830	107.3035	110.8868	102.4645	96.1537	108.6157	109.3970	112.2211	116.6974	114.4564 (64)
	Total per year (kWh/year) = Sum(64)m = 1317.7443 (64)											
Heat gains from water heating, kWh/month												
	53.0569	46.4874	48.1691	42.2750	40.7723	35.4893	33.1874	37.6525	37.9732	43.8811	47.5382	51.4748 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)
Water heating gains (Table 5)	71.3130	69.1777	64.7435	58.7152	54.8015	49.2907	44.6067	50.6082	52.7405	58.9799	66.0253	69.1866 (72)
Total internal gains	372.6280	370.4916	356.9883	335.2531	313.2031	291.9864	278.2352	284.2377	295.4391	317.3855	342.5671	361.4344 (73)

[Jan				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				1.0000	36.7938	0.6300	0.7000	0.7700	11.2447 (77)			
South				7.0200	46.7521	0.6300	0.7000	0.7700	100.3020 (78)			
Southwest				1.0000	36.7938	0.6300	0.7000	0.7700	11.2447 (79)			
West				3.8000	19.6403	0.6300	0.7000	0.7700	22.8088 (80)			
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691	124.6732 (83)
Total gains	518.2282	617.6870	692.1329	743.8617	763.7282	735.8201	707.5883	683.0348	656.2397	589.8471	516.8362	486.1076 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.4516	56.6364	56.8187	57.6909	57.8570	58.6433	58.6433	58.7913	58.3379	57.8570	57.5219	57.1756
alpha	4.7634	4.7758	4.7879	4.8461	4.8571	4.9096	4.9096	4.9194	4.8892	4.8571	4.8348	4.8117
util living area	0.9966	0.9917	0.9800	0.9481	0.8719	0.7190	0.5479	0.5865	0.8115	0.9608	0.9926	0.9975 (86)
MIT	19.7236	19.9135	20.1795	20.5032	20.7716	20.9385	20.9869	20.9818	20.8835	20.5281	20.0639	19.6946 (87)
Th 2	19.9328	19.9359	19.9389	19.9533	19.9559	19.9685	19.9685	19.9708	19.9636	19.9559	19.9505	19.9448 (88)
util rest of house	0.9955	0.9890	0.9733	0.9298	0.8260	0.6286	0.4271	0.4659	0.7347	0.9432	0.9898	0.9967 (89)
MIT 2	18.2403	18.5186	18.9050	19.3730	19.7298	19.9263	19.9635	19.9631	19.8716	19.4170	18.7493	18.2064 (90)
Living area fraction									fLA = Living area / (4) =			0.2942 (91)
MIT	18.6767	18.9289	19.2800	19.7055	20.0363	20.2241	20.2645	20.2628	20.1693	19.7439	19.1360	18.6442 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6767	18.9289	19.2800	19.7055	20.0363	20.2241	20.2645	20.2628	20.1693	19.7439	19.1360	18.6442 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9936	0.9855	0.9678	0.9245	0.8300	0.6526	0.4628	0.5014	0.7518	0.9386	0.9866	0.9952 (94)
Useful gains	514.9000	608.7064	669.8274	687.6809	633.8859	480.1939	327.4753	342.4912	493.3368	553.6344	509.9241	483.7561 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1352.2647	1315.2495	1194.3125	994.5287	765.0586	509.2279	331.8030	348.8745	552.4176	839.1768	1111.0398	1341.4111 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	622.9993	474.7969	390.2169	220.9304	97.5924	0.0000	0.0000	0.0000	0.0000	212.4435	432.8033	638.0953 (98)
Space heating												3089.8782 (98)
Space heating per m2												38.8957 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.7000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3444.6802 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	622.9993	474.7969	390.2169	220.9304	97.5924	0.0000	0.0000	0.0000	0.0000	212.4435	432.8033	638.0953 (98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000 (210)
Space heating fuel (main heating system)	694.5366	529.3165	435.0244	246.2993	108.7987	0.0000	0.0000	0.0000	0.0000	236.8378	482.5009	711.3660 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	119.3731	107.7920	116.3830	107.3035	110.8868	102.4645	96.1537	108.6157	109.3970	112.2211	112.6974	114.4564 (64)
Efficiency of water heater (217)m	89.2376	89.1684	89.0409	88.7650	88.1886	86.9000	86.9000	86.9000	86.9000	88.7120	89.1068	86.9000 (216)
Fuel for water heating, kWh/month	133.7699	120.8859	130.7073	120.8849	125.7381	117.9109	110.6487	124.9894	125.8883	126.5005	126.4745	128.2244 (219)
Water heating fuel used												1492.6229 (219)
Annual totals kWh/year												
Space heating fuel - main system												3444.6802 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												357.9139 (232)
Total delivered energy for all uses												5370.2170 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3444.6802	0.2160	744.0509 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1492.6229	0.2160	322.4065 (264)
Space and water heating			1066.4575 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	357.9139	0.5190	185.7573 (268)
Total CO2, kg/year			1291.1398 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.2500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.2500 ZC1
Total Floor Area	TFA	79.4400
Assumed number of occupants	N	2.4521
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.2815 ZC2
CO2 emissions from cooking, equation (L16)		2.2388 ZC3
Total CO2 emissions		34.7703 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.7703 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1800	7.4088		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
PIJ	29.8500		29.8500	0.1300	3.8805		(30)
Total net area of external elements Aum(A, m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1685		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1105 (36)
Total fabric heat loss							(33) + (36) = 46.2790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	87.4370	87.1927	86.9532	85.8284	85.6179	84.6382	84.6382	84.4568	85.0156	85.6179	86.0436	86.4887 (39)
Average = Sum(39)m / 12 =												85.8274 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1007	1.0976	1.0946	1.0804	1.0778	1.0654	1.0654	1.0632	1.0702	1.0778	1.0831	1.0887 (40)
HLP (average)												1.0804 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	45.0999	48.0478	44.6744	44.2793	41.0275	42.3951	44.2793	44.6744	48.0478	48.3213	50.9589 (61)
Total heat required for water heating calculated for each month	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (64)
Heat gains from water heating, kWh/month	62.8781	55.1263	57.2626	50.6192	48.9236	42.9218	40.8677	45.8038	46.3174	52.9745	56.7942	61.2961 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	84.5136	82.0332	76.9659	70.3045	65.7576	59.6137	54.9296	61.5643	64.3298	71.2023	78.8808	82.3872	(72)
Total internal gains	385.8285	383.3471	369.2107	346.8423	324.1592	302.3093	288.5581	295.1938	307.0283	329.6079	355.4226	374.6349	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast			1.0000		36.7938	0.6300		0.7000		0.7700		11.2447 (77)
South			7.0200		46.7521	0.6300		0.7000		0.7700		100.3020 (78)
Southwest			1.0000		36.7938	0.6300		0.7000		0.7700		11.2447 (79)
West			3.8000		19.6403	0.6300		0.7000		0.7700		22.8088 (80)
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691	124.6732 (83)
Total gains	531.4287	630.5426	704.3553	755.4510	774.6843	746.1430	717.9112	693.9909	667.8290	602.0695	529.6917	499.3082 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	63.0931	63.2699	63.4441	64.2756	64.4336	65.1794	65.1794	65.3194	64.8901	64.4336	64.1147	63.7848
alpha	5.2062	5.2180	5.2296	5.2850	5.2956	5.3453	5.3453	5.3546	5.3260	5.2956	5.2743	5.2523
util living area	0.9967	0.9915	0.9784	0.9414	0.8525	0.6846	0.5111	0.5485	0.7827	0.9554	0.9924	0.9976 (86)
MIT	19.8899	20.0706	20.3173	20.6080	20.8373	20.9630	20.9935	20.9906	20.9234	20.6224	20.1977	19.8583 (87)
Th 2	20.0003	20.0028	20.0053	20.0169	20.0190	20.0292	20.0292	20.0310	20.0253	20.0190	20.0146	20.0100 (88)
util rest of house	0.9956	0.9887	0.9712	0.9212	0.8038	0.5973	0.4024	0.4388	0.7047	0.9359	0.9894	0.9968 (89)
MIT 2	18.5262	18.7905	19.1477	19.5640	19.8619	20.0048	20.0268	20.0272	19.9670	19.5927	18.9854	18.4872 (90)
Living area fraction	18.9274	19.1671	19.4918	19.8711	20.1488	20.2867	20.3111	20.3106	20.2484	19.8956	19.3421	18.8905 (92)
MIT	18.9274	19.1671	19.4918	19.8711	20.1488	20.2867	20.3111	20.3106	20.2484	19.8956	19.3421	18.8905 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9274	19.1671	19.4918	19.8711	20.1488	20.2867	20.3111	20.3106	20.2484	19.8956	19.3421	18.8905 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9939	0.9856	0.9664	0.9177	0.8110	0.6216	0.4345	0.4712	0.7241	0.9329	0.9866	0.9955 (94)
Useful gains	528.2050	621.4385	680.6875	693.2503	628.2583	463.8261	311.9637	327.0018	483.6032	561.6464	522.5844	497.0573 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1278.9719	1243.9871	1129.6747	941.6357	723.3717	481.3086	314.1043	330.2787	522.7072	795.8738	1053.3513	1270.5666 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	558.5706	418.3527	334.0464	178.8375	70.7643	0.0000	0.0000	0.0000	0.0000	174.2652	382.1522	575.4909 (98)
Space heating												2692.4797 (98)
Space heating per m2												33.8932 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2882.7406 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	558.5706	418.3527	334.0464	178.8375	70.7643	0.0000	0.0000	0.0000	0.0000	174.2652	382.1522	575.4909	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	598.0413	447.9151	357.6514	191.4748	75.7648	0.0000	0.0000	0.0000	0.0000	186.5794	409.1566	616.1572	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930	(64)
Efficiency of water heater (217)m	87.4803	87.1416	86.5324	85.2800	83.1729	80.3000	80.3000	80.3000	80.3000	85.0952	86.8648	80.3000	(216)
Fuel for water heating, kWh/month	230.6244	203.0988	212.7990	191.5137	190.1164	173.4346	166.1636	185.2334	187.2791	201.2374	210.4408	224.9021	(219)
Water heating fuel used												2376.8434	(219)
Annual totals kWh/year													
Space heating fuel - main system												2882.7406	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												357.9139	(232)
Total delivered energy for all uses												5692.4980	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2882.7406	0.2160	622.6720 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2376.8434	0.2160	513.3982 (264)
Space and water heating			1136.0702 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	357.9139	0.5190	185.7573 (268)
Total CO2, kg/m2/year			1360.7525 (272)
Emissions per m2 for space and water heating			14.3010 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3383 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3010 * 1.00) + 2.3383 + 0.4900, rounded to 2 d.p.			17.1300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-07			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT Mid		
Property	Plot 7, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	84 B	DER	16.93	TER	18.20
Environmental	88 B	% DER<TER	6.96		
CO ₂ Emissions (t/year)	1.02	DFEE	43.72	TFEE	48.23
General Requirements Compliance	Pass	% DFEE<TFEE	9.35		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.2041 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4541 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1700	6.3121	9.0000	334.1700 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
PIJ	27.8100		27.8100	0.1300	3.6153	9.0000	250.2900 (30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.9676		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Floor 1			73.6900			30.0000	2210.7000 (32d)
Party Ceilings 1			45.8800			30.0000	1376.4000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (User defined value 0.150 * total exposed area)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18406.3100 (34)
249.7803 (35)
12.0675 (36)
(33) + (36) = 40.0351 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	80.2096	79.9055	79.6074	78.2072	77.9452	76.7257	76.7257	76.4999	77.1955	77.9452	78.4752	79.0292 (39)
Average = Sum(39)m / 12 =												78.2060 (39)
HLP	1.0885	1.0843	1.0803	1.0613	1.0577	1.0412	1.0412	1.0381	1.0476	1.0577	1.0649	1.0725 (40)
HLP (average)												1.0613 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	(61)
Total heat required for water heating calculated for each month	157.8219	138.3661	143.5747	126.2917	122.0137	106.5122	99.9045	112.9198	113.7524	131.0754	141.6334	153.2104	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
FGHRS	-40.1507	-33.6665	-31.4794	-22.8922	-14.5446	-6.8555	-6.3526	-7.2897	-7.3768	-23.3024	-31.6832	-39.9213	eq. (G2)
Output from w/h	117.6712	104.6996	112.0953	103.3995	107.4691	99.6567	93.5519	105.6301	106.3756	107.7730	109.9502	113.2891	(64)
Heat gains from water heating, kWh/month	51.5127	45.1368	46.7755	41.0599	39.6065	34.4833	32.2551	36.5827	36.8906	42.6195	46.1611	49.9794	(65)
Total per year (kWh/year) = Sum(63)m =													1281.5614 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(69)
Pumps, fans	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(70)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(71)
Water heating gains (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(72)
Total internal gains	69.2375	67.1679	62.8703	57.0277	53.2345	47.8934	43.3537	49.1703	51.2370	57.2842	64.1126	67.1766	(73)
	355.2092	353.1240	340.2555	319.5835	298.6757	278.5209	265.4374	271.2698	281.9073	302.7840	326.7269	344.6046	(74)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				9.7300	10.6334	0.6300	0.7000			0.7700			31.6196 (74)
West				1.7600	19.6403	0.6300	0.7000			0.7700			10.5641 (80)
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471	(83)
Total gains	397.3929	434.2163	476.9685	534.1489	581.6816	578.6371	546.7809	498.3697	444.9437	399.2355	378.9059	379.6517	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	63.7438	63.9864	64.2260	65.3759	65.5956	66.6382	66.6382	66.8349	66.2327	65.5956	65.1526	64.6958	
alpha	5.2496	5.2658	5.2817	5.3584	5.3730	5.4425	5.4425	5.4557	5.4155	5.3730	5.3435	5.3131	
util living area	0.9988	0.9978	0.9945	0.9791	0.9197	0.7681	0.5995	0.6713	0.9092	0.9886	0.9977	0.9991	(86)
MIT	19.7842	19.8987	20.1216	20.4513	20.7536	20.9393	20.9872	20.9774	20.8335	20.4604	20.0766	19.7731	(87)
Th 2	20.0103	20.0136	20.0170	20.0326	20.0355	20.0491	20.0491	20.0517	20.0439	20.0355	20.0296	20.0234	(88)
util rest of house	0.9984	0.9971	0.9924	0.9705	0.8857	0.6835	0.4791	0.5498	0.8568	0.9825	0.9967	0.9988	(89)
MIT 2	18.3793	18.5490	18.8766	19.3637	19.7800	20.0061	20.0441	20.0415	19.8962	19.3834	18.8210	18.3725	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	18.7556	18.9105	19.2101	19.6551	20.0408	20.2561	20.2967	20.2922	20.1473	19.6719	19.1574	18.7477	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7556	18.9105	19.2101	19.6551	20.0408	20.2561	20.2967	20.2922	20.1473	19.6719	19.1574	18.7477	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9958	0.9900	0.9661	0.8860	0.7035	0.5116	0.5824	0.8637	0.9793	0.9955	0.9981	(94)
Ext temp.	396.4462	432.3975	472.1777	516.0292	515.3510	407.0919	279.7436	290.2689	384.2760	390.9614	377.1925	378.9452	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1159.4797	1119.5178	1011.8204	841.1231	650.1256	433.9706	283.6350	297.7536	466.8208	707.1143	946.2033	1149.6910	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	567.6969	461.7448	401.4941	234.0677	100.2724	0.0000	0.0000	0.0000	0.0000	235.2178	409.6878	573.4349	(98)
Space heating per m2												2983.6164	(98)
										(98) / (4) =		40.4888	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.7000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3326.2167 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	567.6969	461.7448	401.4941	234.0677	100.2724	0.0000	0.0000	0.0000	0.0000	235.2178	409.6878	573.4349 (98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000 (210)
Space heating fuel (main heating system)	632.8840	514.7657	447.5966	260.9450	111.7864	0.0000	0.0000	0.0000	0.0000	262.2272	456.7311	639.2808 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	117.6712	104.6996	112.0953	103.3995	107.4691	99.6567	93.5519	105.6301	106.3756	107.7730	109.9502	113.2891 (64)
Efficiency of water heater (217)m	89.2065	89.1689	89.0736	88.8231	88.2293	86.9000	86.9000	86.9000	86.9000	88.8010	89.0926	86.9000 (216)
Fuel for water heating, kWh/month	131.9087	117.4172	125.8458	116.4106	121.8066	114.6798	107.6547	121.5536	122.4116	121.3647	123.4111	89.2257 (217)
Water heating fuel used												1451.4334 (219)
Annual totals kWh/year												
Space heating fuel - main system												3326.2167 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												339.7119 (232)
Total delivered energy for all uses												5192.3619 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3326.2167	0.2160	718.4628 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1451.4334	0.2160	313.5096 (264)
Space and water heating			1031.9724 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/year			1247.2079 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9300 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.9300 ZC1
Total Floor Area	TFA	73.6900
Assumed number of occupants	N	2.3323
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.5455 ZC2
CO2 emissions from cooking, equation (L16)		2.3745 ZC3
Total CO2 emissions		35.8500 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.8500 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
PIJ	27.8100		27.8100	0.1300	3.6153		(30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8543		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8613 (36)
Total fabric heat loss							(33) + (36) = 37.7156 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	76.2290	75.9894	75.7545	74.6513	74.4449	73.4840	73.4840	73.3061	73.8541	74.4449	74.8624	75.2990 (39)
Average = Sum(39)m / 12 =												74.6503 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0345	1.0312	1.0280	1.0130	1.0102	0.9972	0.9972	0.9948	1.0022	1.0102	1.0159	1.0218 (40)
HLP (average)												1.0130 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.2204	43.7109	46.5680	43.2985	42.9156	39.7639	41.0894	42.9156	43.2985	46.5680	46.8331	50.2204 (61)
Total heat required for water heating calculated for each month	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (64)
Heat gains from water heating, kWh/month	61.1493	53.4285	55.4990	49.0602	47.4169	41.5999	39.6090	44.3931	44.8909	51.3430	55.0450	59.6160 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)	82.1899	79.5067	74.5954	68.1392	63.7323	57.7776	53.2379	59.6682	62.3485	69.0094	76.4514	80.1290	(72)
Total internal gains	368.1616	365.4628	351.9806	330.6950	309.1736	288.4051	275.3216	281.7676	293.0188	314.5091	339.0657	357.5571	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196	
West					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)	
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	410.3453	446.5550	488.6936	545.2604	592.1795	588.5213	556.6651	508.8675	456.0552	410.9607	391.2447	392.6041 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1314	67.3431	67.5519	68.5502	68.7403	69.6391	69.6391	69.8082	69.2901	68.7403	68.3569	67.9606	
alpha	5.4754	5.4895	5.5035	5.5700	5.5827	5.6426	5.6426	5.6539	5.6193	5.5827	5.5571	5.5307	
util living area	0.9986	0.9975	0.9935	0.9753	0.9059	0.7406	0.5692	0.6393	0.8918	0.9861	0.9973	0.9989	(86)
MIT	19.8762	19.9865	20.2011	20.5144	20.7961	20.9549	20.9915	20.9844	20.8652	20.5175	20.1503	19.8610	(87)
Th 2	20.0547	20.0574	20.0601	20.0725	20.0748	20.0857	20.0857	20.0877	20.0815	20.0748	20.0701	20.0652	(88)
util rest of house	0.9982	0.9966	0.9911	0.9654	0.8690	0.6572	0.4570	0.5242	0.8351	0.9789	0.9962	0.9986	(89)
MIT 2	18.5457	18.7090	19.0237	19.4835	19.8663	20.0543	20.0823	20.0808	19.9646	19.4944	18.9580	18.5312	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	18.9021	19.0512	19.3391	19.7597	20.1154	20.2955	20.3259	20.3228	20.2059	19.7684	19.2774	18.8874	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9021	19.0512	19.3391	19.7597	20.1154	20.2955	20.3259	20.3228	20.2059	19.7684	19.2774	18.8874	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	409.2460	444.4509	483.1240	524.0976	515.7331	398.8190	271.2304	282.4911	384.9576	400.9787	389.2070	391.7792	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1113.1057	1075.3407	972.6184	810.6902	626.4841	418.5314	273.7915	287.5677	450.9448	682.5422	911.6287	1105.9489	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	523.6716	423.9579	364.1838	206.3467	82.3987	0.0000	0.0000	0.0000	0.0000	209.4833	376.1436	531.3423	(98)
Space heating												2717.5279	(98)
Space heating per m2										(98) / (4) =		36.8778	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2909.5588	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	523.6716 423.9579 364.1838 206.3467 82.3987 0.0000 0.0000 0.0000 0.0000 209.4833 376.1436 531.3423	(98)
Space heating efficiency (main heating system 1)	93.4000 93.4000 93.4000 93.4000 93.4000 0.0000 0.0000 0.0000 0.0000 93.4000 93.4000 93.4000	(210)
Space heating fuel (main heating system)	560.6762 453.9164 389.9184 220.9279 88.2213 0.0000 0.0000 0.0000 0.0000 224.2862 402.7233 568.8889	(211)
Water heating requirement	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(215)
Water heating		
Water heating requirement	196.3683 171.5328 178.4687 158.2928 153.2553 134.9787 129.3199 144.1614 145.7535 165.9694 177.1691 191.7568	(64)
Efficiency of water heater	87.4019 87.2393 86.8090 85.7196 83.5645 80.3000 80.3000 80.3000 80.3000 85.6385 86.9002 87.4821	(216)
(217)m	87.4019 87.2393 86.8090 85.7196 83.5645 80.3000 80.3000 80.3000 80.3000 85.6385 86.9002 87.4821	(217)
Fuel for water heating, kWh/month	224.6727 196.6234 205.5877 184.6635 183.3976 168.0931 161.0460 179.5285 181.5112 193.8024 203.8765 219.1956	(219)
Water heating fuel used		2301.9982 (219)
Annual totals kWh/year		
Space heating fuel - main system		2909.5588 (211)
Space heating fuel - secondary		0.0000 (215)
Electricity for pumps and fans:		
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		75.0000 (231)
Electricity for lighting (calculated in Appendix L)		339.7119 (232)
Total delivered energy for all uses		5626.2688 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2909.5588	0.2160	628.4647 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2301.9982	0.2160	497.2316 (264)
Space and water heating			1125.6963 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1340.9318 (272)
Emissions per m2 for space and water heating			15.2761 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2761 * 1.00) + 2.3926 + 0.5282, rounded to 2 d.p.			18.2000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-08			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT Mid		
Property	Plot 8, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	84 B	DER	17.06	TER	18.11
Environmental	89 B	% DER<TER	5.81		
CO ₂ Emissions (t/year)	0.82	DFEE	40.08	TFEE	42.16
General Requirements Compliance	Pass	% DFEE<TFEE	4.96		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4788	0.4694	0.4600	0.4131	0.4037	0.3568	0.3568	0.3474	0.3755	0.4037	0.4225	0.4413 (22b)
Effective ac	0.6146	0.6102	0.6058	0.5853	0.5815	0.5636	0.5636	0.5603	0.5705	0.5815	0.5892	0.5974 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
Main Type 4	19.0300	8.4600	10.5700	0.1700	1.7969	9.0000	95.1300 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
PIJ	13.7000		13.7000	0.1300	1.7810	9.0000	123.3000 (30)
Total net area of external elements Aum(A, m ²)			51.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.9893		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Floor 1			58.8000			30.0000	1764.0000 (32d)
Party Ceilings 1			45.1000			30.0000	1353.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (User defined value 0.150 * total exposed area)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 14671.7800 (34)												
249.5201 (35)												
7.7640 (36)												
(33) + (36) = 28.7533 (37)												
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	31.7238	31.4941	31.2689	30.2111	30.0132	29.0920	29.0920	28.9214	29.4468	30.0132	30.4136	30.8321 (38)
Heat transfer coeff	60.4772	60.2474	60.0222	58.9645	58.7666	57.8453	57.8453	57.6747	58.2002	58.7666	59.1669	59.5855 (39)
Average = Sum(39)m / 12 =												58.9635 (39)
HLP	1.0285	1.0246	1.0208	1.0028	0.9994	0.9838	0.9838	0.9809	0.9898	0.9994	1.0062	1.0134 (40)
HLP (average)												1.0028 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
												1.9475 (42)
												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740	(61)
Total heat required for water heating calculated for each month	142.9150	125.3285	130.1210	114.5624	110.7592	96.8004	90.9051	102.5928	103.3021	118.8966	128.3393	138.7739	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
FGHRS	-32.0163	-27.2304	-25.7662	-18.7437	-11.8938	-6.1562	-5.7046	-6.5462	-6.6243	-18.8404	-25.7153	-31.7970	eq. (G2)
Output from w/h	110.8987	98.0981	104.3548	95.8187	98.8654	90.6442	85.2004	96.0467	96.6778	100.0562	102.6239	106.9769	(64)
Heat gains from water heating, kWh/month	46.5561	40.8018	42.3021	37.1600	35.8643	31.2541	29.2628	33.1490	33.4159	38.5700	41.7408	45.1792	(65)
Total per year (kWh/year) = Sum(63)m =													

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138	(68)
Pumps, fans	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	(71)
Total internal gains	62.5754	60.7170	56.8577	51.6111	48.2047	43.4085	39.3318	44.5551	46.4110	51.8414	57.9733	60.7247	(72)
	303.8536	301.9521	290.9702	273.4300	255.8531	238.8064	227.6818	232.9483	241.9267	259.6507	279.9531	294.9550	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				8.4600	10.6334	0.6300	0.7000			0.7700			27.4925 (74)
Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191	(83)
Total gains	331.3461	354.4916	380.2477	416.8326	449.0296	445.6075	420.7570	386.1288	349.2673	322.1922	313.8686	317.8741	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
alpha	67.3890	67.6460	67.8998	69.1178	69.3505	70.4550	70.4550	70.6634	70.0255	69.3505	68.8813	68.3975		
util living area	5.4926	5.5097	5.5267	5.6079	5.6234	5.6970	5.6970	5.7109	5.6684	5.6234	5.5921	5.5598		
	0.9985	0.9975	0.9942	0.9790	0.9188	0.7620	0.5908	0.6597	0.9025	0.9869	0.9972	0.9988	(86)	
MIT	19.8890	19.9910	20.1935	20.4980	20.7797	20.9494	20.9902	20.9825	20.8577	20.5177	20.1631	19.8786	(87)	
Th 2	20.0596	20.0629	20.0660	20.0810	20.0838	20.0969	20.0969	20.0993	20.0918	20.0838	20.0781	20.0722	(88)	
util rest of house														
	0.9980	0.9967	0.9920	0.9705	0.8855	0.6802	0.4769	0.5440	0.8494	0.9801	0.9960	0.9985	(89)	
MIT 2	18.5684	18.7196	19.0174	19.4676	19.8547	20.0610	20.0929	20.0914	19.9662	19.5019	18.9828	18.5624	(90)	
Living area fraction									fLA = Living area / (4) =			0.3240	(91)	
MIT	18.9962	19.1315	19.3984	19.8015	20.1544	20.3488	20.3836	20.3801	20.2550	19.8310	19.3652	18.9888	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9962	19.1315	19.3984	19.8015	20.1544	20.3488	20.3836	20.3801	20.2550	19.8310	19.3652	18.9888	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9972	0.9955	0.9899	0.9671	0.8884	0.7047	0.5141	0.5817	0.8606	0.9776	0.9948	0.9978	(94)	
Ext temp.	330.4241	352.8852	376.4077	403.1372	398.9401	314.0052	216.2974	224.6241	300.5737	314.9754	312.2209	317.1719	(95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Month fracti	888.7862	857.4114	774.1909	642.7986	496.8356	332.5419	218.8657	229.5502	358.2229	542.4751	725.6938	881.1985	(97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating per m2	415.4214	339.0416	295.9507	172.5562	72.8343	0.0000	0.0000	0.0000	0.0000	169.2598	297.7005	419.6358	(98)	
												2182.4004	(98)	
												37.1157	(99)	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2432.9993 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	415.4214	339.0416	295.9507	172.5562	72.8343	0.0000	0.0000	0.0000	0.0000	169.2598	297.7005	419.6358	(98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)
Space heating fuel (main heating system)	463.1230	377.9728	329.9339	192.3704	81.1977	0.0000	0.0000	0.0000	0.0000	188.6954	331.8846	467.8214	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	110.8987	98.0981	104.3548	95.8187	98.8654	90.6442	85.2004	96.0467	96.6778	100.0562	102.6239	106.9769	(64)
Efficiency of water heater (217)m	89.0951	89.0561	88.9528	88.6798	88.0661	86.9000	86.9000	86.9000	86.9000	88.6389	88.9652	89.1167	(216)
Fuel for water heating, kWh/month	124.4722	110.1532	117.3148	108.0502	112.2627	104.3086	98.0442	110.5255	111.2518	112.8806	115.3529	120.0414	(219)
Water heating fuel used												1344.6582	(219)
Annual totals kWh/year													
Space heating fuel - main system												2432.9993	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												285.3006	(232)
Total delivered energy for all uses												4137.9580	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2432.9993	0.2160	525.5278 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1344.6582	0.2160	290.4462 (264)
Space and water heating			815.9740 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	285.3006	0.5190	148.0710 (268)
Total CO2, kg/year			1002.9700 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.0600 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.0600	ZC1
Total Floor Area	TFA	58.8000	
Assumed number of occupants	N	1.9475	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1234	ZC2
CO2 emissions from cooking, equation (L16)		2.8187	ZC3
Total CO2 emissions		37.0021	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.0021	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1279 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3779 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3212 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3613	0.3774 (22b)
Effective ac	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
Main Type 4	19.0300	8.4600	10.5700	0.1800	1.9026		(29a)
Corridor	19.0300	1.9500	17.0800	0.1800	3.0744		(29a)
PIJ	13.7000		13.7000	0.1300	1.7810		(30)
Total net area of external elements Aum(A, m ²)			51.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.9239		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4053 (36)
Total fabric heat loss						(33) + (36) =	25.3292 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1353	29.9673	29.8025	29.0288	28.8840	28.2101	28.2101	28.0853	28.4697	28.8840	29.1769	29.4830 (38)
Heat transfer coeff	55.4645	55.2965	55.1317	54.3580	54.2132	53.5393	53.5393	53.4145	53.7989	54.2132	54.5061	54.8123 (39)
Average = Sum(39)m / 12 =												54.3573 (39)
HLP	0.9433	0.9404	0.9376	0.9245	0.9220	0.9105	0.9105	0.9084	0.9149	0.9220	0.9270	0.9322 (40)
HLP (average)												0.9244 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	45.0980	39.2524	41.8181	38.8821	38.5383	35.7081	36.8983	38.5383	38.8821	41.8181	42.0562	45.0980 (61)
Total heat required for water heating calculated for each month	176.3390	154.0366	160.2651	142.1471	137.6235	121.2111	116.1294	129.4571	130.8868	149.0407	159.0980	172.1979 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	176.3390	154.0366	160.2651	142.1471	137.6235	121.2111	116.1294	129.4571	130.8868	149.0407	159.0980	172.1979 (64)
Heat gains from water heating, kWh/month	54.9121	47.9789	49.8382	44.0561	42.5804	37.3568	35.5689	39.8651	40.3121	46.1061	49.4305	53.5352 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004 (71)
Water heating gains (Table 5)	73.8066	71.3971	66.9868	61.1891	57.2317	51.8844	47.8077	53.5821	55.9890	61.9705	68.6534	71.9559 (72)
Total internal gains	315.0848	312.6322	301.0993	283.0080	264.8801	247.2823	236.1577	241.9752	251.5048	269.7798	290.6333	306.1862 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				8.4600	10.6334	0.6300	0.7000	0.7700	27.4925 (74)			
Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191 (83)
Total gains	342.5773	365.1717	390.3768	426.4106	458.0566	454.0834	429.2330	395.1558	358.8453	332.3213	324.5488	329.1053 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	73.6206	73.8444	74.0650	75.1193	75.3199	76.2679	76.2679	76.4461	75.9000	75.3199	74.9152	74.4967
alpha	5.9080	5.9230	5.9377	6.0080	6.0213	6.0845	6.0845	6.0964	6.0600	6.0213	5.9943	5.9664
util living area	0.9982	0.9970	0.9927	0.9727	0.8953	0.7160	0.5423	0.6084	0.8725	0.9826	0.9964	0.9986 (86)
MIT	20.0303	20.1262	20.3157	20.5953	20.8432	20.9707	20.9953	20.9911	20.9030	20.6046	20.2771	20.0151 (87)
Th 2	20.1309	20.1333	20.1356	20.1468	20.1488	20.1586	20.1586	20.1604	20.1548	20.1488	20.1446	20.1402 (88)
util rest of house	0.9977	0.9960	0.9901	0.9622	0.8576	0.6372	0.4421	0.5042	0.8137	0.9740	0.9950	0.9982 (89)
MIT 2	18.8272	18.9691	19.2468	19.6563	19.9896	20.1384	20.1567	20.1564	20.0723	19.6754	19.1984	18.8121 (90)
Living area fraction	19.2170	19.3440	19.5931	19.9605	20.2662	20.4080	20.4284	20.4268	20.3414	19.9764	19.5478	19.2018 (91)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (92)
adjusted MIT	19.2170	19.3440	19.5931	19.9605	20.2662	20.4080	20.4284	20.4268	20.3414	19.9764	19.5478	19.2018 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9968	0.9947	0.9879	0.9594	0.8634	0.6617	0.4747	0.5382	0.8283	0.9718	0.9937	0.9975 (94)
Ext temp.	341.4778	363.2401	385.6506	409.1169	395.4886	300.4488	203.7705	212.6554	297.2390	322.9448	322.5003	328.2672 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	827.3641	798.7017	721.8449	601.2277	464.3998	310.9574	204.9697	215.0921	335.7818	508.3259	678.4826	822.2835 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	361.4994	292.6302	250.1285	138.3198	51.2700	0.0000	0.0000	0.0000	0.0000	137.9236	256.3073	367.5481 (98)
												1855.6268 (98)
												31.5583 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1986.7525 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	361.4994	292.6302	250.1285	138.3198	51.2700	0.0000	0.0000	0.0000	0.0000	137.9236	256.3073	367.5481	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	387.0443	313.3085	267.8036	148.0940	54.8929	0.0000	0.0000	0.0000	0.0000	147.6698	274.4189	393.5205	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	176.3390	154.0366	160.2651	142.1471	137.6235	121.2111	116.1294	129.4571	130.8868	149.0407	159.0980	172.1979	(64)
Efficiency of water heater	86.8197	86.6419	86.1676	84.9826	82.8112	80.3000	80.3000	80.3000	80.3000	84.8567	86.2454	86.9124	(216)
Fuel for water heating, kWh/month	203.1094	177.7855	185.9924	167.2662	166.1894	150.9478	144.6195	161.2168	162.9973	175.6382	184.4714	198.1281	(219)
Water heating fuel used												2078.3619	(219)
Annual totals kWh/year													
Space heating fuel - main system												1986.7525	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												285.3006	(232)
Total delivered energy for all uses												4425.4149	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1986.7525	0.2160	429.1385 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2078.3619	0.2160	448.9262 (264)
Space and water heating			878.0647 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	285.3006	0.5190	148.0710 (268)
Total CO2, kg/m2/year			1065.0607 (272)
Emissions per m2 for space and water heating			14.9331 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5182 (272b)
Emissions per m2 for pumps and fans			0.6620 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9331 * 1.00) + 2.5182 + 0.6620, rounded to 2 d.p.			18.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-09			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT Mid		
Property	Plot 9, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	84 B	DER	16.93	TER	18.20
Environmental	88 B	% DER<TER	6.96		
CO ₂ Emissions (t/year)	1.02	DFEE	43.72	TFEE	48.23
General Requirements Compliance	Pass	% DFEE<TFEE	9.35		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.2041 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4541 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1700	6.3121	9.0000	334.1700 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
PIJ	27.8100		27.8100	0.1300	3.6153	9.0000	250.2900 (30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.9676		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Floor 1			73.6900			30.0000	2210.7000 (32d)
Party Ceilings 1			45.8800			30.0000	1376.4000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (User defined value 0.150 * total exposed area)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18406.3100 (34)
249.7803 (35)
12.0675 (36)
(33) + (36) = 40.0351 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	80.2096	79.9055	79.6074	78.2072	77.9452	76.7257	76.7257	76.4999	77.1955	77.9452	78.4752	79.0292 (39)
Average = Sum(39)m / 12 =												78.2060 (39)
HLP	1.0885	1.0843	1.0803	1.0613	1.0577	1.0412	1.0412	1.0381	1.0476	1.0577	1.0649	1.0725 (40)
HLP (average)												1.0613 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	(61)
Total heat required for water heating calculated for each month	157.8219	138.3661	143.5747	126.2917	122.0137	106.5122	99.9045	112.9198	113.7524	131.0754	141.6334	153.2104	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
FGHRS	-40.1507	-33.6665	-31.4794	-22.8922	-14.5446	-6.8555	-6.3526	-7.2897	-7.3768	-23.3024	-31.6832	-39.9213	eq. (G2)
Output from w/h	117.6712	104.6996	112.0953	103.3995	107.4691	99.6567	93.5519	105.6301	106.3756	107.7730	109.9502	113.2891	(64)
Heat gains from water heating, kWh/month	51.5127	45.1368	46.7755	41.0599	39.6065	34.4833	32.2551	36.5827	36.8906	42.6195	46.1611	49.9794	(65)
Total per year (kWh/year) = Sum(63)m =													1281.5614 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Pumps, fans	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Total internal gains	69.2375	67.1679	62.8703	57.0277	53.2345	47.8934	43.3537	49.1703	51.2370	57.2842	64.1126	67.1766	(72)
	355.2092	353.1240	340.2555	319.5835	298.6757	278.5209	265.4374	271.2698	281.9073	302.7840	326.7269	344.6046	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				9.7300	10.6334	0.6300	0.7000			0.7700			31.6196 (74)
East				1.7600	19.6403	0.6300	0.7000			0.7700			10.5641 (76)
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471	(83)
Total gains	397.3929	434.2163	476.9685	534.1489	581.6816	578.6371	546.7809	498.3697	444.9437	399.2355	378.9059	379.6517	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	63.7438	63.9864	64.2260	65.3759	65.5956	66.6382	66.6382	66.8349	66.2327	65.5956	65.1526	64.6958	
alpha	5.2496	5.2658	5.2817	5.3584	5.3730	5.4425	5.4425	5.4557	5.4155	5.3730	5.3435	5.3131	
util living area	0.9988	0.9978	0.9945	0.9791	0.9197	0.7681	0.5995	0.6713	0.9092	0.9886	0.9977	0.9991	(86)
MIT	19.7842	19.8987	20.1216	20.4513	20.7536	20.9393	20.9872	20.9774	20.8335	20.4604	20.0766	19.7731	(87)
Th 2	20.0103	20.0136	20.0170	20.0326	20.0355	20.0491	20.0491	20.0517	20.0439	20.0355	20.0296	20.0234	(88)
util rest of house	0.9984	0.9971	0.9924	0.9705	0.8857	0.6835	0.4791	0.5498	0.8568	0.9825	0.9967	0.9988	(89)
MIT 2	18.3793	18.5490	18.8766	19.3637	19.7800	20.0061	20.0441	20.0415	19.8962	19.3834	18.8210	18.3725	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	18.7556	18.9105	19.2101	19.6551	20.0408	20.2561	20.2967	20.2922	20.1473	19.6719	19.1574	18.7477	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7556	18.9105	19.2101	19.6551	20.0408	20.2561	20.2967	20.2922	20.1473	19.6719	19.1574	18.7477	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9958	0.9900	0.9661	0.8860	0.7035	0.5116	0.5824	0.8637	0.9793	0.9955	0.9981	(94)
Ext temp.	396.4462	432.3975	472.1777	516.0292	515.3510	407.0919	279.7436	290.2689	384.2760	390.9614	377.1925	378.9452	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1159.4797	1119.5178	1011.8204	841.1231	650.1256	433.9706	283.6350	297.7536	466.8208	707.1143	946.2033	1149.6910	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	567.6969	461.7448	401.4941	234.0677	100.2724	0.0000	0.0000	0.0000	0.0000	235.2178	409.6878	573.4349	(98)
Space heating per m2												2983.6164	(98)
										(98) / (4) =		40.4888	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.7000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3326.2167 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	567.6969	461.7448	401.4941	234.0677	100.2724	0.0000	0.0000	0.0000	0.0000	235.2178	409.6878	573.4349 (98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000 (210)
Space heating fuel (main heating system)	632.8840	514.7657	447.5966	260.9450	111.7864	0.0000	0.0000	0.0000	0.0000	262.2272	456.7311	639.2808 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	117.6712	104.6996	112.0953	103.3995	107.4691	99.6567	93.5519	105.6301	106.3756	107.7730	109.9502	113.2891 (64)
Efficiency of water heater (217)m	89.2065	89.1689	89.0736	88.8231	88.2293	86.9000	86.9000	86.9000	86.9000	88.8010	89.0926	86.9000 (216)
Fuel for water heating, kWh/month	131.9087	117.4172	125.8458	116.4106	121.8066	114.6798	107.6547	121.5536	122.4116	121.3647	123.4111	89.2257 (217)
Water heating fuel used												126.9691 (219)
Annual totals kWh/year												1451.4334 (219)
Space heating fuel - main system												3326.2167 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												339.7119 (232)
Total delivered energy for all uses												5192.3619 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3326.2167	0.2160	718.4628 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1451.4334	0.2160	313.5096 (264)
Space and water heating			1031.9724 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/year			1247.2079 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9300 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.9300 ZC1
Total Floor Area	TFA	73.6900
Assumed number of occupants	N	2.3323
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.5455 ZC2
CO2 emissions from cooking, equation (L16)		2.3745 ZC3
Total CO2 emissions		35.8500 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.8500 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
PIJ	27.8100		27.8100	0.1300	3.6153		(30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.8543		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8613 (36)
Total fabric heat loss						(33) + (36) =	37.7156 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	76.2290	75.9894	75.7545	74.6513	74.4449	73.4840	73.4840	73.3061	73.8541	74.4449	74.8624	75.2990 (39)
Average = Sum(39)m / 12 =												74.6503 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0345	1.0312	1.0280	1.0130	1.0102	0.9972	0.9972	0.9948	1.0022	1.0102	1.0159	1.0218 (40)
HLP (average)												1.0130 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.2204	43.7109	46.5680	43.2985	42.9156	39.7639	41.0894	42.9156	43.2985	46.5680	46.8331	50.2204 (61)
Total heat required for water heating calculated for each month	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568 (64)
Heat gains from water heating, kWh/month	61.1493	53.4285	55.4990	49.0602	47.4169	41.5999	39.6090	44.3931	44.8909	51.3430	55.0450	59.6160 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	82.1899	79.5067	74.5954	68.1392	63.7323	57.7776	53.2379	59.6682	62.3485	69.0094	76.4514	80.1290 (72)
Total internal gains	368.1616	365.4628	351.9806	330.6950	309.1736	288.4051	275.3216	281.7676	293.0188	314.5091	339.0657	357.5571 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					9.7300	10.6334	0.6300	0.7000	0.7700		31.6196	
East					1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (74)	
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	410.3453	446.5550	488.6936	545.2604	592.1795	588.5213	556.6651	508.8675	456.0552	410.9607	391.2447	392.6041 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	67.1314	67.3431	67.5519	68.5502	68.7403	69.6391	69.6391	69.8082	69.2901	68.7403	68.3569	67.9606
alpha	5.4754	5.4895	5.5035	5.5700	5.5827	5.6426	5.6426	5.6539	5.6193	5.5827	5.5571	5.5307
util living area	0.9986	0.9975	0.9935	0.9753	0.9059	0.7406	0.5692	0.6393	0.8918	0.9861	0.9973	0.9989 (86)
MIT	19.8762	19.9865	20.2011	20.5144	20.7961	20.9549	20.9915	20.9844	20.8652	20.5175	20.1503	19.8610 (87)
Th 2	20.0547	20.0574	20.0601	20.0725	20.0748	20.0857	20.0857	20.0877	20.0815	20.0748	20.0701	20.0652 (88)
util rest of house	0.9982	0.9966	0.9911	0.9654	0.8690	0.6572	0.4570	0.5242	0.8351	0.9789	0.9962	0.9986 (89)
MIT 2	18.5457	18.7090	19.0237	19.4835	19.8663	20.0543	20.0823	20.0808	19.9646	19.4944	18.9580	18.5312 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	18.9021	19.0512	19.3391	19.7597	20.1154	20.2955	20.3259	20.3228	20.2059	19.7684	19.2774	18.8874 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9021	19.0512	19.3391	19.7597	20.1154	20.2955	20.3259	20.3228	20.2059	19.7684	19.2774	18.8874 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9973	0.9953	0.9886	0.9612	0.8709	0.6777	0.4872	0.5551	0.8441	0.9757	0.9948	0.9979 (94)
Useful gains	409.2460	444.4509	483.1240	524.0976	515.7331	398.8190	271.2304	282.4911	384.9576	400.9787	389.2070	391.7792 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1113.1057	1075.3407	972.6184	810.6902	626.4841	418.5314	273.7915	287.5677	450.9448	682.5422	911.6287	1105.9489 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	523.6716	423.9579	364.1838	206.3467	82.3987	0.0000	0.0000	0.0000	0.0000	209.4833	376.1436	531.3423 (98)
Space heating												2717.5279 (98)
Space heating per m2										(98) / (4) =		36.8778 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2909.5588	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	523.6716	423.9579	364.1838	206.3467	82.3987	0.0000	0.0000	0.0000	0.0000	209.4833	376.1436	531.3423	(98)	
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)	
Space heating fuel (main heating system)	560.6762	453.9164	389.9184	220.9279	88.2213	0.0000	0.0000	0.0000	0.0000	224.2862	402.7233	568.8889	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	196.3683	171.5328	178.4687	158.2928	153.2553	134.9787	129.3199	144.1614	145.7535	165.9694	177.1691	191.7568	(64)	
Efficiency of water heater	87.4019	87.2393	86.8090	85.7196	83.5645	80.3000	80.3000	80.3000	80.3000	85.6385	86.9002	87.4821	(216)	
(217)m	87.4019	87.2393	86.8090	85.7196	83.5645	80.3000	80.3000	80.3000	80.3000	85.6385	86.9002	87.4821	(217)	
Fuel for water heating, kWh/month	224.6727	196.6234	205.5877	184.6635	183.3976	168.0931	161.0460	179.5285	181.5112	193.8024	203.8765	219.1956	(219)	
Water heating fuel used												2301.9982	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2909.5588	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												75.0000	(231)	
Electricity for lighting (calculated in Appendix L)												339.7119	(232)	
Total delivered energy for all uses												5626.2688	(238)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2909.5588	0.2160	628.4647 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2301.9982	0.2160	497.2316 (264)
Space and water heating			1125.6963 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1340.9318 (272)
Emissions per m2 for space and water heating			15.2761 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2761 * 1.00) + 2.3926 + 0.5282, rounded to 2 d.p.			18.2000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-10			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT Mid		
Property	Plot 10, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	85 B	DER	16.25	TER	17.13
Environmental	88 B	% DER<TER	5.13		
CO ₂ Emissions (t/year)	1.07	DFEE	42.60	TFEE	44.96
General Requirements Compliance	Pass	% DFEE<TFEE	5.25		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum (m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area)		16.1445 (36)
Total fabric heat loss	(33) + (36) =	51.2907 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	94.0596	93.7527	93.4519	92.0391	91.7748	90.5443	90.5443	90.3164	91.0182	91.7748	92.3095	92.8686 (39)
Average = Sum(39)m / 12 =												92.0379 (39)
HLP	1.1840	1.1802	1.1764	1.1586	1.1553	1.1398	1.1398	1.1369	1.1457	1.1553	1.1620	1.1690 (40)
HLP (average)												1.1586 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740	(61)
Total heat required for water heating calculated for each month	162.4661	142.4280	147.7662	129.9459	125.5200	109.5379	102.7082	116.1371	117.0081	134.8696	145.7751	157.7081	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
FGHRS	-43.0929	-34.6359	-31.3832	-22.6424	-14.6332	-7.0733	-6.5545	-7.5213	-7.6112	-22.6485	-33.0777	-43.2517	eq. (G2)
Output from w/h	119.3731	107.7920	116.3830	107.3035	110.8868	102.4645	96.1537	108.6157	109.3970	112.2211	112.6974	114.4564	(64)
Heat gains from water heating, kWh/month	53.0569	46.4874	48.1691	42.2750	40.7723	35.4893	33.1874	37.6525	37.9732	43.8811	47.5382	51.4748	(65)
Total per year (kWh/year) = Sum(63)m =													1317.7443 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	71.3130	69.1777	64.7435	58.7152	54.8015	49.2907	44.6067	50.6082	52.7405	58.9799	66.0253	69.1866	(72)
Total internal gains	372.6280	370.4916	356.9883	335.2531	313.2031	291.9864	278.2352	284.2377	295.4391	317.3855	342.5671	361.4344	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East				3.8000	19.6403	0.6300	0.7000			0.7700			22.8088 (76)
Southeast				1.0000	36.7938	0.6300	0.7000			0.7700			11.2447 (77)
South				7.0200	46.7521	0.6300	0.7000			0.7700			100.3020 (78)
Southwest				1.0000	36.7938	0.6300	0.7000			0.7700			11.2447 (79)

Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691	124.6732 (83)	
Total gains	518.2282	617.6870	692.1329	743.8617	763.7282	735.8201	707.5883	683.0348	656.2397	589.8471	516.8362	486.1076 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4516	56.6364	56.8187	57.6909	57.8570	58.6433	58.6433	58.7913	58.3379	57.8570	57.5219	57.1756	
alpha	4.7634	4.7758	4.7879	4.8461	4.8571	4.9096	4.9096	4.9194	4.8892	4.8571	4.8348	4.8117	
util living area	0.9966	0.9917	0.9800	0.9481	0.8719	0.7190	0.5479	0.5865	0.8115	0.9608	0.9926	0.9975	(86)
MIT	19.7236	19.9135	20.1795	20.5032	20.7716	20.9385	20.9869	20.9818	20.8835	20.5281	20.0639	19.6946	(87)
Th 2	19.9328	19.9359	19.9389	19.9533	19.9559	19.9685	19.9685	19.9708	19.9636	19.9559	19.9505	19.9448	(88)
util rest of house	0.9955	0.9890	0.9733	0.9298	0.8260	0.6286	0.4271	0.4659	0.7347	0.9432	0.9898	0.9967	(89)
MIT 2	18.2403	18.5186	18.9050	19.3730	19.7298	19.9263	19.9635	19.9631	19.8716	19.4170	18.7493	18.2064	(90)
Living area fraction	18.6767	18.9289	19.2800	19.7055	20.0363	20.2241	20.2645	20.2628	20.1693	19.7439	19.1360	18.6442	(91)
MIT	18.6767	18.9289	19.2800	19.7055	20.0363	20.2241	20.2645	20.2628	20.1693	19.7439	19.1360	18.6442	(92)
Temperature adjustment	18.6767	18.9289	19.2800	19.7055	20.0363	20.2241	20.2645	20.2628	20.1693	19.7439	19.1360	18.6442	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	514.9000	608.7064	669.8274	687.6809	633.8859	480.1939	327.4753	342.4912	493.3368	553.6344	509.9241	483.7561	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1352.2647	1315.2495	1194.3125	994.5287	765.0586	509.2279	331.8030	348.8745	552.4176	839.1768	1111.0398	1341.4111	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	622.9993	474.7969	390.2169	220.9304	97.5924	0.0000	0.0000	0.0000	0.0000	212.4435	432.8033	638.0953	(98)
Space heating												3089.8782	(98)
Space heating per m2												38.8957	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.7000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3444.6802 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	622.9993	474.7969	390.2169	220.9304	97.5924	0.0000	0.0000	0.0000	0.0000	212.4435	432.8033	638.0953 (98)
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000 (210)
Space heating fuel (main heating system)	694.5366	529.3165	435.0244	246.2993	108.7987	0.0000	0.0000	0.0000	0.0000	236.8378	482.5009	711.3660 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	119.3731	107.7920	116.3830	107.3035	110.8868	102.4645	96.1537	108.6157	109.3970	112.2211	112.6974	114.4564 (64)
Efficiency of water heater (217)m	89.2376	89.1684	89.0409	88.7650	88.1886	86.9000	86.9000	86.9000	86.9000	88.7120	89.1068	86.9000 (216)
Fuel for water heating, kWh/month	133.7699	120.8859	130.7073	120.8849	125.7381	117.9109	110.6487	124.9894	125.8883	126.5005	126.4745	128.2244 (219)
Water heating fuel used												1492.6229 (219)
Annual totals kWh/year												
Space heating fuel - main system												3444.6802 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												357.9139 (232)
Total delivered energy for all uses												5370.2170 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3444.6802	0.2160	744.0509 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1492.6229	0.2160	322.4065 (264)
Space and water heating			1066.4575 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	357.9139	0.5190	185.7573 (268)
Total CO2, kg/year			1291.1398 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.2500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.2500 ZC1
Total Floor Area	TFA	79.4400
Assumed number of occupants	N	2.4521
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.2815 ZC2
CO2 emissions from cooking, equation (L16)		2.2388 ZC3
Total CO2 emissions		34.7703 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.7703 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1800	7.4088		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
PIJ	29.8500		29.8500	0.1300	3.8805		(30)
Total net area of external elements Aum(A, m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1685		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1105 (36)
Total fabric heat loss							(33) + (36) = 46.2790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	87.4370	87.1927	86.9532	85.8284	85.6179	84.6382	84.6382	84.4568	85.0156	85.6179	86.0436	86.4887 (39)
Average = Sum(39)m / 12 =												85.8274 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1007	1.0976	1.0946	1.0804	1.0778	1.0654	1.0654	1.0632	1.0702	1.0778	1.0831	1.0887 (40)
HLP (average)												1.0804 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	45.0999	48.0478	44.6744	44.2793	41.0275	42.3951	44.2793	44.6744	48.0478	48.3213	50.9589 (61)
Total heat required for water heating calculated for each month	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (64)
Heat gains from water heating, kWh/month	62.8781	55.1263	57.2626	50.6192	48.9236	42.9218	40.8677	45.8038	46.3174	52.9745	56.7942	61.2961 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	84.5136	82.0332	76.9659	70.3045	65.7576	59.6137	54.9296	61.5643	64.3298	71.2023	78.8808	82.3872	(72)
Total internal gains	385.8285	383.3471	369.2107	346.8423	324.1592	302.3093	288.5581	295.1938	307.0283	329.6079	355.4226	374.6349	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				3.8000	19.6403		0.6300		0.7000		0.7700		22.8088 (76)
Southeast				1.0000	36.7938		0.6300		0.7000		0.7700		11.2447 (77)
South				7.0200	46.7521		0.6300		0.7000		0.7700		100.3020 (78)
Southwest				1.0000	36.7938		0.6300		0.7000		0.7700		11.2447 (79)
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691		124.6732 (83)
Total gains	531.4287	630.5426	704.3553	755.4510	774.6843	746.1430	717.9112	693.9909	667.8290	602.0695	529.6917		499.3082 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	63.0931	63.2699	63.4441	64.2756	64.4336	65.1794	65.1794	65.3194	64.8901	64.4336	64.1147	63.7848
alpha	5.2062	5.2180	5.2296	5.2850	5.2956	5.3453	5.3453	5.3546	5.3260	5.2956	5.2743	5.2523
util living area	0.9967	0.9915	0.9784	0.9414	0.8525	0.6846	0.5111	0.5485	0.7827	0.9554	0.9924	0.9976 (86)
MIT	19.8899	20.0706	20.3173	20.6080	20.8373	20.9630	20.9935	20.9906	20.9234	20.6224	20.1977	19.8583 (87)
Th 2	20.0003	20.0028	20.0053	20.0169	20.0190	20.0292	20.0292	20.0310	20.0253	20.0190	20.0146	20.0100 (88)
util rest of house	0.9956	0.9887	0.9712	0.9212	0.8038	0.5973	0.4024	0.4388	0.7047	0.9359	0.9894	0.9968 (89)
MIT 2	18.5262	18.7905	19.1477	19.5640	19.8619	20.0048	20.0268	20.0272	19.9670	19.5927	18.9854	18.4872 (90)
Living area fraction	18.9274	19.1671	19.4918	19.8711	20.1488	20.2867	20.3111	20.3106	20.2484	19.8956	19.3421	18.8905 (92)
MIT	18.9274	19.1671	19.4918	19.8711	20.1488	20.2867	20.3111	20.3106	20.2484	19.8956	19.3421	18.8905 (93)
Temperature adjustment												0.0000
adjusted MIT	18.9274	19.1671	19.4918	19.8711	20.1488	20.2867	20.3111	20.3106	20.2484	19.8956	19.3421	18.8905 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9939	0.9856	0.9664	0.9177	0.8110	0.6216	0.4345	0.4712	0.7241	0.9329	0.9866	0.9955 (94)
Useful gains	528.2050	621.4385	680.6875	693.2503	628.2583	463.8261	311.9637	327.0018	483.6032	561.6464	522.5844	497.0573 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1278.9719	1243.9871	1129.6747	941.6357	723.3717	481.3086	314.1043	330.2787	522.7072	795.8738	1053.3513	1270.5666 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	558.5706	418.3527	334.0464	178.8375	70.7643	0.0000	0.0000	0.0000	0.0000	174.2652	382.1522	575.4909 (98)
Space heating												2692.4797 (98)
Space heating per m2												33.8932 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2882.7406 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	558.5706	418.3527	334.0464	178.8375	70.7643	0.0000	0.0000	0.0000	0.0000	174.2652	382.1522	575.4909 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	598.0413	447.9151	357.6514	191.4748	75.7648	0.0000	0.0000	0.0000	0.0000	186.5794	409.1566	616.1572 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	201.7510	176.9836	184.1400	163.3229	158.1254	139.2680	133.4293	148.7424	150.3851	171.2435	182.7990	196.9930 (64)
Efficiency of water heater (217)m	87.4803	87.1416	86.5324	85.2800	83.1729	80.3000	80.3000	80.3000	80.3000	85.0952	86.8648	80.3000 (216)
Fuel for water heating, kWh/month	230.6244	203.0988	212.7990	191.5137	190.1164	173.4346	166.1636	185.2334	187.2791	201.2374	210.4408	224.9021 (219)
Water heating fuel used												2376.8434 (219)
Annual totals kWh/year												
Space heating fuel - main system												2882.7406 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												357.9139 (232)
Total delivered energy for all uses												5692.4980 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2882.7406	0.2160	622.6720 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2376.8434	0.2160	513.3982 (264)
Space and water heating			1136.0702 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	357.9139	0.5190	185.7573 (268)
Total CO2, kg/m2/year			1360.7525 (272)
Emissions per m2 for space and water heating			14.3010 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3383 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3010 * 1.00) + 2.3383 + 0.4900, rounded to 2 d.p.			17.1300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-11				Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT Top			
Property	Plot 11, Green Lane, NORTHWOOD, HA6 2UZ					
SAP Rating	84 B	DER	17.45	TER	20.95	
Environmental	85 B	% DER<TER	16.69			
CO ₂ Emissions (t/year)	1.56	DFEE	55.60	TFEE	70.58	
General Requirements Compliance	Pass	% DFEE<TFEE	21.22			
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com				Assessor ID	B342-0001
Client	Bluesky, Ivan Ball					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1120 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3620 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3077 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3923	0.3846	0.3769	0.3384	0.3307	0.2923	0.2923	0.2846	0.3077	0.3307	0.3461	0.3615 (22b)
Effective ac	0.5769	0.5739	0.5710	0.5573	0.5547	0.5427	0.5427	0.5405	0.5473	0.5547	0.5599	0.5653 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1700	1.8173	9.0000	96.2100 (29a)
Corridor	26.3400	1.9500	24.3900	0.2257	5.5056	110.0000	2682.9000 (29a)
Dwarf	48.7300		48.7300	0.1300	6.3349	9.0000	438.5700 (29a)
PIR	72.4900		72.4900	0.1300	9.4237	9.0000	652.4100 (30)
Flat	52.2800		52.2800	0.1300	6.7964	9.0000	470.5200 (30)
Total net area of external elements Aum, m ²			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9168		(33)
Party Wall 1			8.6800	0.0000	0.0000	20.0000	173.6000 (32)
Party Floor 1			102.2800			40.0000	4091.2000 (32d)
Internal Wall 1			173.3800			9.0000	1560.4200 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10165.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 99.3922 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 33.5820 (36)
Total fabric heat loss (33) + (36) = 83.4988 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.0192	50.7550	50.4960	49.2797	49.0521	47.9928	47.9928	47.7966	48.4008	49.0521	49.5125	49.9938 (38)
Heat transfer coeff	134.5180	134.2538	133.9948	132.7785	132.5509	131.4916	131.4916	131.2954	131.8996	132.5509	133.0113	133.4926 (39)
Average = Sum(39)m / 12 =												132.7774 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3126	1.3101	1.2982	1.2960	1.2856	1.2856	1.2837	1.2896	1.2960	1.3005	1.3052 (40)
HLP (average)												1.2982 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740	11.2974	11.6740	11.2974	11.6740 (61)
Total heat required for water heating calculated for each month	174.3796	152.8476	158.5183	139.3198	134.5145	117.2995	109.9005	124.3903	125.3599	144.6029	156.3997	169.2456 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum(63)m =			0.0000 (63)
FGHRS	-55.0154	-46.1840	-44.3635	-33.7628	-26.0729	-7.6321	-7.0723	-8.1156	-8.2125	-32.4557	-43.5093	-54.9247 eq. (G2)
Output from w/h	119.3641	106.6636	114.1547	105.5570	108.4417	109.6673	102.8282	116.2747	117.1474	112.1471	112.8904	114.3209 (64)
								Total per year (kWh/year) =	Sum(64)m =			1339.4572 (64)
Heat gains from water heating, kWh/month	57.0181	49.9519	51.7442	45.3918	43.7630	38.0700	35.5788	40.3967	40.7501	47.1173	51.0709	55.3111 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861 (71)
Water heating gains (Table 5)	76.6372	74.3332	69.5487	63.0442	58.8212	52.8750	47.8210	54.2966	56.5974	63.3298	70.9317	74.3428 (72)
Total internal gains	429.2432	426.8137	411.0433	385.6363	359.6590	334.9359	319.1133	325.7145	339.0011	364.6360	393.9922	416.1803 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					10.0800	10.6334	0.6300	0.7000	0.7700		32.7570 (74)	
South					3.2700	46.7521	0.6300	0.7000	0.7700		46.7219 (78)	
Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799 (83)
Total gains	508.7221	565.9324	614.8874	666.6622	704.6237	691.8136	657.1027	613.0544	568.7161	521.6858	489.7836	483.8602 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.9923	21.0336	21.0743	21.2673	21.3038	21.4755	21.4755	21.5075	21.4090	21.3038	21.2301	21.1535
alpha	2.3995	2.4022	2.4050	2.4178	2.4203	2.4317	2.4317	2.4338	2.4273	2.4203	2.4153	2.4102
util living area	0.9779	0.9702	0.9562	0.9266	0.8702	0.7743	0.6623	0.7035	0.8503	0.9386	0.9700	0.9804 (86)
MIT	18.1004	18.3244	18.7498	19.3513	19.9663	20.4879	20.7600	20.7107	20.2869	19.5170	18.7113	18.0586 (87)
Th 2	19.8290	19.8310	19.8329	19.8423	19.8440	19.8521	19.8521	19.8536	19.8490	19.8440	19.8405	19.8368 (88)
util rest of house	0.9743	0.9651	0.9482	0.9115	0.8389	0.7080	0.5471	0.5963	0.8016	0.9231	0.9640	0.9772 (89)
MIT 2	15.9600	16.2867	16.9056	17.7783	18.6505	19.3597	19.6850	19.6381	19.1085	18.0266	16.8575	15.9032 (90)
Living area fraction	0.9743	0.9651	0.9482	0.9115	0.8389	0.7080	0.5471	0.5963	0.8016	0.9231	0.9640	0.9772 (89)
MIT	16.4985	16.7993	17.3695	18.1740	18.9815	19.6435	19.9554	19.9079	19.4049	18.4015	17.3239	16.4454 (92)
Temperature adjustment												0.0000
adjusted MIT	16.4985	16.7993	17.3695	18.1740	18.9815	19.6435	19.9554	19.9079	19.4049	18.4015	17.3239	16.4454 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	487.1890	534.8094	567.7234	587.6085	569.8599	479.7563	367.3573	369.2565	442.1348	467.0772	462.3455	465.4583 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1640.9133	1597.5327	1456.4573	1231.3935	965.1667	663.1784	441.2132	460.5707	699.7169	1034.0979	1359.8926	1634.6759 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	858.3709	714.1500	661.2180	463.5252	294.1083	0.0000	0.0000	0.0000	0.0000	421.8634	646.2339	869.8979 (98)
Space heating												4929.3676 (98)
Space heating per m ²										(98) / (4) =		48.1948 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													89.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5495.3931	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	858.3709	714.1500	661.2180	463.5252	294.1083	0.0000	0.0000	0.0000	0.0000	421.8634	646.2339	869.8979	(98)	
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)	
Space heating fuel (main heating system)	956.9352	796.1538	737.1438	516.7505	327.8799	0.0000	0.0000	0.0000	0.0000	470.3048	720.4391	969.7859	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	119.3641	106.6636	114.1547	105.5570	108.4417	109.6673	102.8282	116.2747	117.1474	112.1471	112.8904	114.3209	(64)	
Efficiency of water heater (217)m	89.3485	89.3260	89.2765	89.1671	88.9281	86.9000	86.9000	86.9000	86.9000	89.0971	89.2722	89.3655	(216)	
Fuel for water heating, kWh/month	133.5938	119.4094	127.8665	118.3811	121.9431	126.1994	118.3293	133.8029	134.8072	125.8707	126.4563	127.9250	(219)	
Water heating fuel used												1514.5847	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5495.3931	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												75.0000	(231)	
Electricity for lighting (calculated in Appendix L)												445.9101	(232)	
Total delivered energy for all uses												7530.8880	(238)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5495.3931	0.2160	1187.0049 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1514.5847	0.2160	327.1503 (264)
Space and water heating			1514.1552 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.9101	0.5190	231.4273 (268)
Total CO2, kg/year			1784.5076 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.4500	ZC1
Total Floor Area	TFA	102.2800	
Assumed number of occupants	N	2.7597	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0614	ZC2
CO2 emissions from cooking, equation (L16)		1.8110	ZC3
Total CO2 emissions		34.3224	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.3224	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.1493 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3993 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3394 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1800	1.9242		(29a)
Corridor	26.3400	1.9500	24.3900	0.1800	4.3902		(29a)
Dwarf	48.7300		48.7300	0.1800	8.7714		(29a)
PIR	72.4900		72.4900	0.1300	9.4237		(30)
Flat	52.2800		52.2800	0.1300	6.7964		(30)
Total net area of external elements Aum(A, m ²)			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9548		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.1690 (36)
Total fabric heat loss						(33) + (36) =	85.1238 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.4944	52.1729	51.8578	50.3777	50.1008	48.8118	48.8118	48.5730	49.3083	50.1008	50.6610	51.2467 (38)
Heat transfer coeff	137.6181	137.2967	136.9816	135.5015	135.2246	133.9355	133.9355	133.6968	134.4321	135.2246	135.7848	136.3704 (39)
Average = Sum(39)m / 12 =												135.5002 (39)
HLP	1.3455	1.3424	1.3393	1.3248	1.3221	1.3095	1.3095	1.3072	1.3144	1.3221	1.3276	1.3333 (40)
HLP (average)												1.3248 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	48.2040	47.7777	44.2689	45.7446	47.7777	48.2040	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	213.6645	188.3307	197.8032	176.2264	170.6182	150.2710	143.9711	160.4940	162.2665	183.8878	194.4173	208.5306	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	213.6645	188.3307	197.8032	176.2264	170.6182	150.2710	143.9711	160.4940	162.2665	183.8878	194.4173	208.5306	(64)
Heat gains from water heating, kWh/month	66.8393	58.8227	61.5655	54.6184	52.7889	46.3129	44.0965	49.4226	49.9768	56.9386	60.5753	65.1323	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	(71)
Water heating gains (Table 5)	89.8378	87.5338	82.7493	75.8590	70.9528	64.3235	59.2694	66.4282	69.4122	76.5303	84.1323	87.5434	(72)
Total internal gains	442.4438	440.0142	424.2439	398.4511	371.7907	346.3843	330.5618	337.8461	351.8159	377.8366	407.1928	429.3809	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					10.0800	10.6334	0.6300		0.7000		0.7700		32.7570
South					3.2700	46.7521	0.6300		0.7000		0.7700		46.7219 (78)

Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799	(83)
Total gains	521.9226	579.1330	628.0880	679.4770	716.7553	703.2621	668.5511	625.1860	581.5308	534.8863	502.9842	497.0608	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6122	51.7331	51.8521	52.4184	52.5258	53.0313	53.0313	53.1260	52.8354	52.5258	52.3091	52.0844	
alpha	4.4408	4.4489	4.4568	4.4946	4.5017	4.5354	4.5354	4.5417	4.5224	4.5017	4.4873	4.4723	
util living area	0.9989	0.9981	0.9960	0.9887	0.9641	0.8901	0.7642	0.8128	0.9511	0.9920	0.9981	0.9992	(86)
MIT	19.4245	19.5518	19.7922	20.1388	20.4956	20.7937	20.9300	20.9046	20.6661	20.2203	19.7677	19.4056	(87)
Th 2	19.8054	19.8078	19.8102	19.8215	19.8236	19.8334	19.8334	19.8352	19.8296	19.8236	19.8193	19.8148	(88)
util rest of house	0.9985	0.9974	0.9943	0.9834	0.9438	0.8180	0.6128	0.6760	0.9128	0.9872	0.9972	0.9989	(89)
MIT 2	17.7111	17.8988	18.2518	18.7635	19.2732	19.6691	19.8028	19.7873	19.5170	18.8857	18.2228	17.6897	(90)
Living area fraction	18.1422	18.3147	18.6393	19.1095	19.5807	19.9520	20.0864	20.0684	19.8061	19.2215	18.6114	18.1214	(91)
MIT	18.1422	18.3147	18.6393	19.1095	19.5807	19.9520	20.0864	20.0684	19.8061	19.2215	18.6114	18.1214	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1422	18.3147	18.6393	19.1095	19.5807	19.9520	20.0864	20.0684	19.8061	19.2215	18.6114	18.1214	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9977	0.9960	0.9918	0.9787	0.9381	0.8271	0.6505	0.7086	0.9117	0.9836	0.9958	0.9982	(94)
Ext temp.	520.7149	576.8197	622.9634	665.0303	672.3925	581.6564	434.9031	442.9832	530.2014	526.0888	500.8749	496.1445	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1904.9316	1841.7879	1662.8592	1383.4045	1065.6691	716.8280	466.9503	490.4468	767.0772	1165.8351	1563.0777	1898.4644	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1029.8572	850.0587	773.6825	517.2295	292.5978	0.0000	0.0000	0.0000	0.0000	475.9712	764.7860	1043.3260	(98)
Space heating per m2												5747.5089	(98)
												(98) / (4) =	56.1939 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6153.6498 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1029.8572	850.0587	773.6825	517.2295	292.5978	0.0000	0.0000	0.0000	0.0000	475.9712	764.7860	1043.3260 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	1102.6308	910.1271	828.3539	553.7789	313.2739	0.0000	0.0000	0.0000	0.0000	509.6052	818.8287	1117.0514 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	213.6645	188.3307	197.8032	176.2264	170.6182	150.2710	143.9711	160.4940	162.2665	183.8878	194.4173	208.5306 (64)
Efficiency of water heater (217)m	88.4876	88.3838	88.1427	87.6000	86.3973	80.3000	80.3000	80.3000	80.3000	87.3386	88.1527	80.3000 (216)
Fuel for water heating, kWh/month	241.4625	213.0829	224.4125	201.1717	197.4809	187.1370	179.2915	199.8680	202.0753	210.5457	220.5462	235.5085 (219)
Water heating fuel used												2512.5827 (219)
Annual totals kWh/year												
Space heating fuel - main system												6153.6498 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												445.9101 (232)
Total delivered energy for all uses												9187.1426 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6153.6498	0.2160	1329.1884 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2512.5827	0.2160	542.7179 (264)
Space and water heating			1871.9062 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.9101	0.5190	231.4273 (268)
Total CO2, kg/m2/year			2142.2586 (272)
Emissions per m2 for space and water heating			18.3018 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2627 (272b)
Emissions per m2 for pumps and fans			0.3806 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.3018 * 1.00) + 2.2627 + 0.3806, rounded to 2 d.p.			20.9500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-12			Issued on Date	17/09/2021
Assessment Reference	001-1	Prop Type Ref	HT Top		
Property	Plot 12, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	84 B	DER	17.45	TER	20.95
Environmental	85 B	% DER<TER	16.69		
CO ₂ Emissions (t/year)	1.56	DFEE	55.60	TFEE	70.58
General Requirements Compliance	Pass	% DFEE<TFEE	21.22		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1120 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3620 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3077 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3923	0.3846	0.3769	0.3384	0.3307	0.2923	0.2923	0.2846	0.3077	0.3307	0.3461	0.3615 (22b)
Effective ac	0.5769	0.5739	0.5710	0.5573	0.5547	0.5427	0.5427	0.5405	0.5473	0.5547	0.5599	0.5653 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1700	1.8173	9.0000	96.2100 (29a)
Corridor	26.3400	1.9500	24.3900	0.2257	5.5056	110.0000	2682.9000 (29a)
Dwarf	48.7300		48.7300	0.1300	6.3349	9.0000	438.5700 (29a)
PIR	72.4900		72.4900	0.1300	9.4237	9.0000	652.4100 (30)
Flat	52.2800		52.2800	0.1300	6.7964	9.0000	470.5200 (30)
Total net area of external elements Aum, m ²			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9168		(33)
Party Wall 1			8.6800	0.0000	0.0000	20.0000	173.6000 (32)
Party Floor 1			102.2800			40.0000	4091.2000 (32d)
Internal Wall 1			173.3800			9.0000	1560.4200 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10165.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 99.3922 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 33.5820 (36)
Total fabric heat loss (33) + (36) = 83.4988 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.0192	50.7550	50.4960	49.2797	49.0521	47.9928	47.9928	47.7966	48.4008	49.0521	49.5125	49.9938 (38)
Heat transfer coeff	134.5180	134.2538	133.9948	132.7785	132.5509	131.4916	131.4916	131.2954	131.8996	132.5509	133.0113	133.4926 (39)
Average = Sum(39)m / 12 =												132.7774 (39)
HLP	1.3152	1.3126	1.3101	1.2982	1.2960	1.2856	1.2856	1.2837	1.2896	1.2960	1.3005	1.3052 (40)
HLP (average)												1.2982 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.6740	10.5442	11.6740	11.2974	11.6740	11.2974	11.6740	11.6740	11.2974	11.6740	11.2974	11.6740 (61)
Total heat required for water heating calculated for each month	174.3796	152.8476	158.5183	139.3198	134.5145	117.2995	109.9005	124.3903	125.3599	144.6029	156.3997	169.2456 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum(63)m =			0.0000 (63)
FGHRS	-55.0154	-46.1840	-44.3635	-33.7628	-26.0729	-7.6321	-7.0723	-8.1156	-8.2125	-32.4557	-43.5093	-54.9247 eq. (G2)
Output from w/h	119.3641	106.6636	114.1547	105.5570	108.4417	109.6673	102.8282	116.2747	117.1474	112.1471	112.8904	114.3209 (64)
								Total per year (kWh/year) =	Sum(64)m =			1339.4572 (64)
Heat gains from water heating, kWh/month	57.0181	49.9519	51.7442	45.3918	43.7630	38.0700	35.5788	40.3967	40.7501	47.1173	51.0709	55.3111 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861 (71)
Water heating gains (Table 5)	76.6372	74.3332	69.5487	63.0442	58.8212	52.8750	47.8210	54.2966	56.5974	63.3298	70.9317	74.3428 (72)
Total internal gains	429.2432	426.8137	411.0433	385.6363	359.6590	334.9359	319.1133	325.7145	339.0011	364.6360	393.9922	416.1803 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					10.0800	10.6334	0.6300	0.7000	0.7700		32.7570	
South					3.2700	46.7521	0.6300	0.7000	0.7700		46.7219 (78)	
Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799 (83)
Total gains	508.7221	565.9324	614.8874	666.6622	704.6237	691.8136	657.1027	613.0544	568.7161	521.6858	489.7836	483.8602 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.9923	21.0336	21.0743	21.2673	21.3038	21.4755	21.4755	21.5075	21.4090	21.3038	21.2301	21.1535
alpha	2.3995	2.4022	2.4050	2.4178	2.4203	2.4317	2.4317	2.4338	2.4273	2.4203	2.4153	2.4102
util living area	0.9779	0.9702	0.9562	0.9266	0.8702	0.7743	0.6623	0.7035	0.8503	0.9386	0.9700	0.9804 (86)
MIT	18.1004	18.3244	18.7498	19.3513	19.9663	20.4879	20.7600	20.7107	20.2869	19.5170	18.7113	18.0586 (87)
Th 2	19.8290	19.8310	19.8329	19.8423	19.8440	19.8521	19.8521	19.8536	19.8490	19.8440	19.8405	19.8368 (88)
util rest of house	0.9743	0.9651	0.9482	0.9115	0.8389	0.7080	0.5471	0.5963	0.8016	0.9231	0.9640	0.9772 (89)
MIT 2	15.9600	16.2867	16.9056	17.7783	18.6505	19.3597	19.6850	19.6381	19.1085	18.0266	16.8575	15.9032 (90)
Living area fraction	0.9743	0.9651	0.9482	0.9115	0.8389	0.7080	0.5471	0.5963	0.8016	0.9231	0.9640	0.9772 (89)
MIT	16.4985	16.7993	17.3695	18.1740	18.9815	19.6435	19.9554	19.9079	19.4049	18.4015	17.3239	16.4454 (92)
Temperature adjustment												0.0000
adjusted MIT	16.4985	16.7993	17.3695	18.1740	18.9815	19.6435	19.9554	19.9079	19.4049	18.4015	17.3239	16.4454 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	487.1890	534.8094	567.7234	587.6085	569.8599	479.7563	367.3573	369.2565	442.1348	467.0772	462.3455	465.4583 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1640.9133	1597.5327	1456.4573	1231.3935	965.1667	663.1784	441.2132	460.5707	699.7169	1034.0979	1359.8926	1634.6759 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	858.3709	714.1500	661.2180	463.5252	294.1083	0.0000	0.0000	0.0000	0.0000	421.8634	646.2339	869.8979 (98)
Space heating												4929.3676 (98)
Space heating per m ²										(98) / (4) =		48.1948 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													89.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5495.3931	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	858.3709	714.1500	661.2180	463.5252	294.1083	0.0000	0.0000	0.0000	0.0000	421.8634	646.2339	869.8979	(98)	
Space heating efficiency (main heating system 1)	89.7000	89.7000	89.7000	89.7000	89.7000	0.0000	0.0000	0.0000	0.0000	89.7000	89.7000	89.7000	(210)	
Space heating fuel (main heating system)	956.9352	796.1538	737.1438	516.7505	327.8799	0.0000	0.0000	0.0000	0.0000	470.3048	720.4391	969.7859	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	119.3641	106.6636	114.1547	105.5570	108.4417	109.6673	102.8282	116.2747	117.1474	112.1471	112.8904	114.3209	(64)	
Efficiency of water heater (217)m	89.3485	89.3260	89.2765	89.1671	88.9281	86.9000	86.9000	86.9000	86.9000	89.0971	89.2722	89.3655	(216)	
Fuel for water heating, kWh/month	133.5938	119.4094	127.8665	118.3811	121.9431	126.1994	118.3293	133.8029	134.8072	125.8707	126.4563	127.9250	(219)	
Water heating fuel used												1514.5847	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5495.3931	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												75.0000	(231)	
Electricity for lighting (calculated in Appendix L)												445.9101	(232)	
Total delivered energy for all uses												7530.8880	(238)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5495.3931	0.2160	1187.0049 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1514.5847	0.2160	327.1503 (264)
Space and water heating			1514.1552 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.9101	0.5190	231.4273 (268)
Total CO2, kg/year			1784.5076 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.4500	ZC1
Total Floor Area	TFA	102.2800	
Assumed number of occupants	N	2.7597	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0614	ZC2
CO2 emissions from cooking, equation (L16)		1.8110	ZC3
Total CO2 emissions		34.3224	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.3224	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.1493 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3993 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3394 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1800	1.9242		(29a)
Corridor	26.3400	1.9500	24.3900	0.1800	4.3902		(29a)
Dwarf	48.7300		48.7300	0.1800	8.7714		(29a)
PIR	72.4900		72.4900	0.1300	9.4237		(30)
Flat	52.2800		52.2800	0.1300	6.7964		(30)
Total net area of external elements Aum(A, m ²)			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9548		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.1690 (36)
Total fabric heat loss						(33) + (36) =	85.1238 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.4944	52.1729	51.8578	50.3777	50.1008	48.8118	48.8118	48.5730	49.3083	50.1008	50.6610	51.2467 (38)
Heat transfer coeff	137.6181	137.2967	136.9816	135.5015	135.2246	133.9355	133.9355	133.6968	134.4321	135.2246	135.7848	136.3704 (39)
Average = Sum(39)m / 12 =												135.5002 (39)
HLP	1.3455	1.3424	1.3393	1.3248	1.3221	1.3095	1.3095	1.3072	1.3144	1.3221	1.3276	1.3333 (40)
HLP (average)												1.3248 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	48.2040	47.7777	44.2689	45.7446	47.7777	48.2040	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.6645	188.3307	197.8032	176.2264	170.6182	150.2710	143.9711	160.4940	162.2665	183.8878	194.4173	208.5306 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	213.6645	188.3307	197.8032	176.2264	170.6182	150.2710	143.9711	160.4940	162.2665	183.8878	194.4173	208.5306 (64)
Heat gains from water heating, kWh/month	66.8393	58.8227	61.5655	54.6184	52.7889	46.3129	44.0965	49.4226	49.9768	56.9386	60.5753	65.1323 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861 (71)
Water heating gains (Table 5)	89.8378	87.5338	82.7493	75.8590	70.9528	64.3235	59.2694	66.4282	69.4122	76.5303	84.1323	87.5434 (72)
Total internal gains	442.4438	440.0142	424.2439	398.4511	371.7907	346.3843	330.5618	337.8461	351.8159	377.8366	407.1928	429.3809 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					10.0800	10.6334	0.6300		0.7000		0.7700		32.7570 (74)
South					3.2700	46.7521	0.6300		0.7000		0.7700		46.7219 (78)

Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799 (83)	
Total gains	521.9226	579.1330	628.0880	679.4770	716.7553	703.2621	668.5511	625.1860	581.5308	534.8863	502.9842	497.0608 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6122	51.7331	51.8521	52.4184	52.5258	53.0313	53.0313	53.1260	52.8354	52.5258	52.3091	52.0844	
alpha	4.4408	4.4489	4.4568	4.4946	4.5017	4.5354	4.5354	4.5417	4.5224	4.5017	4.4873	4.4723	
util living area	0.9989	0.9981	0.9960	0.9887	0.9641	0.8901	0.7642	0.8128	0.9511	0.9920	0.9981	0.9992 (86)	
MIT	19.4245	19.5518	19.7922	20.1388	20.4956	20.7937	20.9300	20.9046	20.6661	20.2203	19.7677	19.4056 (87)	
Th 2	19.8054	19.8078	19.8102	19.8215	19.8236	19.8334	19.8334	19.8352	19.8296	19.8236	19.8193	19.8148 (88)	
util rest of house	0.9985	0.9974	0.9943	0.9834	0.9438	0.8180	0.6128	0.6760	0.9128	0.9872	0.9972	0.9989 (89)	
MIT 2	17.7111	17.8988	18.2518	18.7635	19.2732	19.6691	19.8028	19.7873	19.5170	18.8857	18.2228	17.6897 (90)	
Living area fraction	18.1422	18.3147	18.6393	19.1095	19.5807	19.9520	20.0864	20.0684	fLOA = Living area / (4) =	19.2215	18.6114	18.1214 (91)	
MIT	18.1422	18.3147	18.6393	19.1095	19.5807	19.9520	20.0864	20.0684	19.8061	19.2215	18.6114	18.1214 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.1422	18.3147	18.6393	19.1095	19.5807	19.9520	20.0864	20.0684	19.8061	19.2215	18.6114	18.1214 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	520.7149	576.8197	622.9634	665.0303	672.3925	581.6564	434.9031	442.9832	530.2014	526.0888	500.8749	496.1445 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1904.9316	1841.7879	1662.8592	1383.4045	1065.6691	716.8280	466.9503	490.4468	767.0772	1165.8351	1563.0777	1898.4644 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1029.8572	850.0587	773.6825	517.2295	292.5978	0.0000	0.0000	0.0000	0.0000	475.9712	764.7860	1043.3260 (98)
Space heating												5747.5089 (98)
Space heating per m2										(98) / (4) =		56.1939 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6153.6498 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1029.8572	850.0587	773.6825	517.2295	292.5978	0.0000	0.0000	0.0000	0.0000	475.9712	764.7860	1043.3260 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	1102.6308	910.1271	828.3539	553.7789	313.2739	0.0000	0.0000	0.0000	0.0000	509.6052	818.8287	1117.0514 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	213.6645	188.3307	197.8032	176.2264	170.6182	150.2710	143.9711	160.4940	162.2665	183.8878	194.4173	208.5306 (64)
Efficiency of water heater (217)m	88.4876	88.3838	88.1427	87.6000	86.3973	80.3000	80.3000	80.3000	80.3000	87.3386	88.1527	80.3000 (216)
Fuel for water heating, kWh/month	241.4625	213.0829	224.4125	201.1717	197.4809	187.1370	179.2915	199.8680	202.0753	210.5457	220.5462	235.5085 (219)
Water heating fuel used												2512.5827 (219)
Annual totals kWh/year												
Space heating fuel - main system												6153.6498 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												445.9101 (232)
Total delivered energy for all uses												9187.1426 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6153.6498	0.2160	1329.1884 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2512.5827	0.2160	542.7179 (264)
Space and water heating			1871.9062 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.9101	0.5190	231.4273 (268)
Total CO2, kg/m2/year			2142.2586 (272)
Emissions per m2 for space and water heating			18.3018 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2627 (272b)
Emissions per m2 for pumps and fans			0.3806 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.3018 * 1.00) + 2.2627 + 0.3806, rounded to 2 d.p.			20.9500 (273)

Appendix 2: 'Be Lean' GLA SAP 10 Spreadsheet

Be Lean - SAP 2012 Methodology SAP 10 Carbon Factors

Project Wetherby House, 15 Green Lane, Northwood
 Client
 Date Oct-21
 Rev A



SAP 2012	Carbon Factor	SAP 10	Carbon Factor
Gas	0.216	Gas	0.210
Grid Elec	0.519	Grid Elec	0.233

Residential Accommodation

TER

DER - Based on Gas Heating with SAP 10 Carbon Factors

Plot	Bedrooms	Floor Area	Location	Space Htg	Water Htg	Pumps & Fans	Lighting	Emissions
1	2	79.4	GND	3136	2373	75	353	1256.6
2	2	73.7	GND	3230	2297	75	340	1257.4
3	1	58.8	GND	2413	2070	75	285	1025.3
4	2	73.7	GND	3230	2297	75	340	1257.4
5	2	79.4	GND	3136	2373	75	353	1256.6
6	2	79.4	MID	2883	2377	75	358	1205.5
7	2	73.7	MID	2910	2302	75	340	1191.2
8	1	58.8	MID	1987	2078	75	285	937.5
9	2	73.7	MID	2910	2302	75	340	1191.2
10	2	79.4	MID	2883	2377	75	358	1205.5
11	2	102.3	TOP	6154	2513	75	446	1941.5
12	2	102.3	TOP	6154	2513	75	446	1941.5
934.7								15667.1

Plot	Space Htg	Water Htg	Pumps & Fans	Lighting	Emissions
1	3533	1489	75	353	1154.3
2	3676	1436	75	340	1170.2
3	2815	1325	75	285	953.3
4	3676	1436	75	340	1170.2
5	3533	1489	75	353	1154.3
6	3445	1493	75	358	1137.9
7	3326	1451	75	340	1099.9
8	2433	1345	75	285	877.3
9	3326	1451	75	340	1099.9
10	3445	1493	75	358	1137.9
11	5395	1515	75	446	1572.5
12	5395	1515	75	446	1572.5
					14100.1

Total Site Target Emissions **15,667** kgCO₂ per year
 Total Site Design Emissions (Be Lean) **14,100** kgCO₂ per year
 Total Reduction **1,567** kgCO₂ per year
 % Reduction **10.00%**

Appendix 3 – SAP Worksheets for units using Communal Air Source Heat Pumps

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-01			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 1, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	14.03	TER	25.54
Environmental	89 B	% DER<TER	45.06		
CO ₂ Emissions (t/year)	0.92	DFEE	43.35	TFEE	48.63
General Requirements Compliance	Pass	% DFEE<TFEE	10.86		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.8758		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	(59)
Total heat required for water heating calculated for each month													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	178.5897	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													(63)
Output from w/h													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	178.5897	(64)
Heat gains from water heating, kWh/month													
86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	80.0034	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148	20.5148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)													
116.4036	114.2683	109.8341	103.8059	99.8921	94.3813	89.6973	95.6988	97.8311	104.0705	111.1159	114.2772	114.2772	(72)
Total internal gains													
414.4121	412.3100	398.8576	377.1761	355.1684	333.9712	320.2115	326.1798	337.3303	359.2229	384.3622	403.2100	403.2100	(73)

6. Solar gains

[Jan]													
	Area	Solar flux	Specific data	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	W/m2	or Table 6c	factor	W						
						Table 6d							
Southeast	1.1100	36.7938	0.6300	0.7000	0.7700	12.4816	(77)						
South	7.7200	46.7521	0.6300	0.7000	0.7700	110.3037	(78)						
Southwest	1.1100	36.7938	0.6300	0.7000	0.7700	12.4816	(79)						
West	3.9900	19.6403	0.6300	0.7000	0.7700	23.9493	(80)						
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705	(83)
Total gains	573.6282	682.3303	764.3071	821.8693	844.8364	816.1205	786.7302	759.9330	730.4432	656.6564	574.8717	539.5805	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	76.7025	76.9480	77.1902	78.3484	78.5690	79.6123	79.6123	79.8086	79.2072	78.5690	78.1240	77.6642	
alpha	6.1135	6.1299	6.1460	6.2232	6.2379	6.3075	6.3075	6.3206	6.2805	6.2379	6.2083	6.1776	
util living area	0.9988	0.9962	0.9883	0.9597	0.8757	0.6973	0.5143	0.5532	0.8018	0.9708	0.9967	0.9992	(86)
MIT	20.0439	20.2003	20.4160	20.6744	20.8760	20.9777	20.9971	20.9955	20.9470	20.6850	20.3135	20.0202	(87)
Th 2	19.9114	19.9145	19.9176	19.9318	19.9345	19.9469	19.9469	19.9492	19.9421	19.9345	19.9291	19.9234	(88)
util rest of house	0.9983	0.9946	0.9828	0.9404	0.8209	0.5966	0.3935	0.4305	0.7111	0.9527	0.9948	0.9988	(89)
MIT 2	18.6526	18.8828	19.1969	19.5702	19.8261	19.9352	19.9462	19.9480	19.9084	19.5931	19.0596	18.6270	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	19.0619	19.2704	19.5555	19.8951	20.1349	20.2419	20.2554	20.2561	20.2139	19.9144	19.4285	19.0368	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0619	19.2704	19.5555	19.8951	20.1349	20.2419	20.2554	20.2561	20.2139	19.9144	19.4285	19.0368	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9977	0.9932	0.9804	0.9396	0.8325	0.6262	0.4293	0.4670	0.7366	0.9523	0.9936	0.9984	(94)
Useful gains	572.2844	677.6599	749.2906	772.2217	703.3268	511.0196	337.7667	354.8561	538.0381	625.3365	571.2064	538.6951	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1419.7798	1377.7137	1247.7277	1035.2717	791.9873	522.7960	338.7168	356.4434	569.4352	874.5585	1164.1594	1409.3116	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	630.5366	470.4361	370.8372	189.3960	65.9634	0.0000	0.0000	0.0000	0.0000	185.4212	426.9261	647.7387	(98)
Space heating												2987.2553	(98)
Space heating per m2										(98) / (4) =		37.6039	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2987.2553	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3136.6181	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1991.1144	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702	(310a)
Electricity used for heat distribution	52.2729	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	352.5010	(332)
Total delivered energy for all uses	5579.7893	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1742.4294	0.5190	904.3209 (367)
Electrical energy for heat distribution	52.2729	0.5190	27.1296 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			931.4505 (373)
Space and water heating			931.4505 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total CO2, kg/year			1114.3985 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0300 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER	14.0300	ZC1
Total Floor Area	79.4400	TFA
Assumed number of occupants	2.4521	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.2815	ZC2
CO2 emissions from cooking, equation (L16)	2.2388	ZC3
Total CO2 emissions	32.5503	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	32.5503	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Heat gains from water heating, kWh/month	89.5325	79.4331	84.6448	77.5740	77.2479	70.7883	69.6630	74.1281	73.2722	80.3567	82.8372	87.9505 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	120.3394	118.2041	113.7699	107.7416	103.8279	98.3171	93.6331	99.6346	101.7669	108.0063	115.0517	118.2130	(72)
Total internal gains	421.3479	419.2458	405.7933	384.1119	362.1042	340.9070	327.1473	333.1155	344.2661	366.1587	391.2980	410.1457	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		Specific data g or Table 6b		Specific data FF or Table 6c		Access factor Table 6d		Gains W
Southeast			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (77)
South			7.7200		46.7521		0.6300		0.7000		0.7700		110.3037 (78)
Southwest			1.1100		36.7938		0.6300		0.7000		0.7700		12.4816 (79)
West			3.9900		19.6403		0.6300		0.7000		0.7700		23.9493 (80)
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705	(83)
Total gains	580.5640	689.2661	771.2429	828.8051	851.7721	823.0563	793.6659	766.8688	737.3790	663.5922	581.8075	546.5162	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175	
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812	
util living area	0.9952	0.9883	0.9721	0.9291	0.8335	0.6639	0.4941	0.5306	0.7606	0.9441	0.9893	0.9964	(86)
MIT	19.8457	20.0374	20.2972	20.5987	20.8333	20.9610	20.9927	20.9897	20.9214	20.6157	20.1708	19.8118	(87)
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498	(88)
util rest of house	0.9936	0.9846	0.9628	0.9054	0.7803	0.5730	0.3824	0.4176	0.6777	0.9202	0.9851	0.9952	(89)
MIT 2	18.4185	18.6981	19.0724	19.5002	19.8010	19.9436	19.9661	19.9664	19.9068	19.5333	18.9019	18.3760	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9913	0.9805	0.9572	0.9018	0.7886	0.5984	0.4154	0.4510	0.6986	0.9172	0.9814	0.9934	(94)
Useful gains	575.5217	675.8279	738.2004	747.3967	671.7008	492.5046	329.7105	345.8511	515.1166	608.6683	570.9964	542.8863	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1356.8294	1321.0514	1200.7221	1001.8805	769.1006	510.8468	332.0674	349.4146	555.0081	846.6104	1119.3159	1348.5884	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424	(98)
Space heating												2785.9543	(98)
Space heating per m2										(98) / (4) =		35.0699	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2979.6303 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	621.7037	463.7328	368.0387	195.9661	77.5031	0.0000	0.0000	0.0000	0.0000	189.3358	422.2353	641.1148 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Efficiency of water heater (217)m	87.4964	87.1223	86.4427	85.0727	82.8121	79.8000	79.8000	79.8000	79.8000	84.8839	86.8247	79.8000 (216)
Fuel for water heating, kWh/month	228.6206	202.4291	214.4020	195.4830	196.9382	182.8254	175.7856	192.6138	192.1866	203.1461	209.7697	222.8846 (219)
Water heating fuel used												2417.0847 (219)
Annual totals kWh/year												
Space heating fuel - main system												2979.6303 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												352.5010 (232)
Total delivered energy for all uses												5824.2161 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2979.6303	0.2160	643.6001 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2417.0847	0.2160	522.0903 (264)
Space and water heating			1165.6904 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/m2/year			1387.5635 (272)
Emissions per m2 for space and water heating			14.6738 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3030 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6738 * 1.55) + 2.3030 + 0.4900, rounded to 2 d.p.			25.5400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-02			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 2, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	15.19	TER	27.50
Environmental	89 B	% DER<TER	44.77		
CO ₂ Emissions (t/year)	0.92	DFEE	47.52	TFEE	53.03
General Requirements Compliance	Pass	% DFEE<TFEE	10.39		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss							(33) + (36) = 43.7911 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3323 (42)
Average daily hot water use (litres/day)	89.5916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(64)
Heat gains from water heating, kWh/month													
85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	83.5268	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)													
114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672	112.2672	(72)
Total internal gains													
397.2998	395.2146	382.3461	361.6741	340.7663	320.6115	307.5281	313.3604	323.9979	344.8746	368.8175	386.6953	386.6953	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North				9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)
West				1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515 52.1790 35.0471 (83)
Total gains	439.4835	476.3069	519.0591	576.2395	623.7723	620.7277	588.8715	540.4603	487.0343	441.3262 420.9965 421.7423 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	87.6276	87.9462	88.2607	89.7684	90.0563	91.4208	91.4208	91.6781	90.8904	90.0563	89.4759	88.8770	
alpha	6.8418	6.8631	6.8840	6.9846	7.0038	7.0947	7.0947	7.1119	7.0594	7.0038	6.9651	6.9251	
util living area	0.9998	0.9995	0.9983	0.9904	0.9434	0.7816	0.5947	0.6680	0.9272	0.9951	0.9994	0.9998	(86)
MIT	20.0871	20.1738	20.3445	20.5993	20.8368	20.9714	20.9963	20.9922	20.8980	20.6091	20.3130	20.0791	(87)
Th 2	19.9688	19.9721	19.9754	19.9908	19.9937	20.0072	20.0072	20.0097	20.0020	19.9937	19.9879	19.9817	(88)
util rest of house	0.9996	0.9992	0.9973	0.9844	0.9082	0.6832	0.4646	0.5331	0.8674	0.9911	0.9990	0.9997	(89)
MIT 2	18.7518	18.8813	19.1333	19.5144	19.8388	19.9917	20.0063	20.0075	19.9247	19.5334	19.0974	18.7503	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9995	0.9989	0.9966	0.9829	0.9129	0.7096	0.4999	0.5700	0.8809	0.9901	0.9987	0.9996	(94)
Useful gains	439.2527	475.7970	517.3173	566.4020	569.4669	440.4527	294.3813	308.0884	429.0103	436.9483	420.4539	421.5784	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
1243.4886	1198.6645	1080.2050	893.8141	686.7907	455.0570	295.4902	310.6935	492.6264	753.4136	1013.3356	1234.0161	1234.0161	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
598.3515	485.7669	418.7885	235.7366	87.2889	0.0000	0.0000	0.0000	0.0000	235.4502	426.8748	604.4536	604.4536	(98)
Space heating												3092.7111	(98)
Space heating per m2												(98) / (4) =	41.9692 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	3092.7111	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3247.3466	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1946.3205	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365	(310a)
Electricity used for heat distribution	52.9098	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	339.7119	(332)
Total delivered energy for all uses	5630.6950	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1763.6610	0.5190	915.3401 (367)
Electrical energy for heat distribution	52.9098	0.5190	27.4602 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			942.8003 (373)
Space and water heating			942.8003 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total CO2, kg/year			1119.1108 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1900 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.1900	ZC1
Total Floor Area	TFA	73.6900	
Assumed number of occupants	N	2.3323	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5455	ZC2
CO2 emissions from cooking, equation (L16)		2.3745	ZC3
Total CO2 emissions		34.1100	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1100	ZC8

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss							(33) + (36) = 42.9985 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (64)
Heat gains from water heating, kWh/month	87.9883	78.0826	83.2511	76.3590	76.0821	69.7823	68.7308	73.0584	72.1896	79.0951	81.4601	86.4550 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	118.2639	116.1943	111.8967	106.0541	102.2609	96.9198	92.3801	98.1967	100.2634	106.3106	113.1390	116.2030 (72)
Total internal gains	404.2356	402.1504	389.2819	368.6099	347.7021	327.5473	314.4638	320.2962	330.9337	351.8104	375.7533	393.6310 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)		
West				1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (80)		
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	446.4193	483.2427	525.9949	583.1753	630.7080	627.6635	595.8073	547.3961	493.9701	448.2619	427.9323	428.6781 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337
util living area	0.9979	0.9964	0.9916	0.9712	0.9003	0.7377	0.5677	0.6341	0.8805	0.9817	0.9960	0.9983 (86)
MIT	19.8235	19.9369	20.1594	20.4830	20.7759	20.9468	20.9892	20.9813	20.8564	20.4979	20.1133	19.8078 (87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061 (88)
util rest of house	0.9972	0.9952	0.9884	0.9597	0.8610	0.6503	0.4493	0.5131	0.8186	0.9724	0.9943	0.9978 (89)
MIT 2	18.4261	18.5936	18.9194	19.3924	19.7888	19.9898	20.0222	20.0202	19.9005	19.4206	18.8606	18.4106 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	444.6323	480.0385	518.2187	556.8291	544.1144	421.4517	286.7243	298.6791	409.2983	434.1455	424.6654	427.2866 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1181.9570	1142.1556	1033.3535	862.0562	665.9875	444.7314	289.9592	304.7430	479.2983	726.2577	969.4542	1175.2769 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048 (98)
Space heating												2853.2938 (98)
Space heating per m2										(98) / (4) =		38.7202 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3051.6511 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	586.7054	475.8746	409.9041	235.0412	96.9771	0.0000	0.0000	0.0000	0.0000	232.4400	419.5165	595.1923	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791	(64)
Efficiency of water heater (217)m	87.4214	87.2349	86.7661	85.6173	83.3715	79.8000	79.8000	79.8000	79.8000	85.4914	86.8645	79.8000	(216)
Fuel for water heating, kWh/month	223.5043	197.5118	208.7721	189.9715	191.4112	179.0338	172.2722	188.5820	188.1068	197.2644	204.9055	218.0218	(219)
Water heating fuel used												2359.3574	(219)
Annual totals kWh/year													
Space heating fuel - main system												3051.6511	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												339.7119	(232)
Total delivered energy for all uses												5825.7204	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3051.6511	0.2160	659.1566 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2359.3574	0.2160	509.6212 (264)
Space and water heating			1168.7778 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1384.0133 (272)
Emissions per m2 for space and water heating			15.8607 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8607 * 1.55) + 2.3926 + 0.5282, rounded to 2 d.p.			27.5000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-03			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 3, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	15.65	TER	28.39
Environmental	90 B	% DER<TER	44.87		
CO ₂ Emissions (t/year)	0.76	DFEE	45.70	TFEE	50.08
General Requirements Compliance	Pass	% DFEE<TFEE	8.75		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4788	0.4694	0.4600	0.4131	0.4037	0.3568	0.3568	0.3474	0.3755	0.4037	0.4225	0.4413 (22b)
Effective ac	0.6146	0.6102	0.6058	0.5853	0.5815	0.5636	0.5636	0.5603	0.5705	0.5815	0.5892	0.5974 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1200	7.0560	75.0000	4410.0000 (28a)
Main Type 3	19.0300	8.4600	10.5700	0.1700	1.7969	110.0000	1162.7000 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.2643			(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			58.8000			30.0000	1764.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18673.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5689 (35)
Thermal bridges (User defined value 0.078 * total exposed area)							7.5551 (36)
Total fabric heat loss							(33) + (36) = 33.8194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	31.7238	31.4941	31.2689	30.2111	30.0132	29.0920	29.0920	28.9214	29.4468	30.0132	30.4136	30.8321 (38)
Heat transfer coeff	65.5432	65.3135	65.0883	64.0306	63.8327	62.9114	62.9114	62.7408	63.2663	63.8327	64.2330	64.6516 (39)
Average = Sum(39)m / 12 =												64.0296 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1147	1.1108	1.1069	1.0890	1.0856	1.0699	1.0699	1.0670	1.0760	1.0856	1.0924	1.0995 (40)
HLP (average)												1.0889 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month														
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum(63)m =					0.0000	(63)
Output from w/h														
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823	(64)	
								Total per year (kWh/year) = Sum(64)m =					1802.5405	(64)
Heat gains from water heating, kWh/month														
	80.1036	71.1027	75.8496	69.6252	69.4118	63.7194	62.8103	66.6964	65.8812	72.1174	74.2060	78.7266	(65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2325.0716 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2441.3252 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1802.5405 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	1892.6676 (310a)
Electricity used for heat distribution	43.3399 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	285.3006 (332)
Total delivered energy for all uses	4619.2933 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1444.6643	0.5190	749.7807 (367)
Electrical energy for heat distribution	43.3399	0.5190	22.4934 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			772.2742 (373)
Space and water heating			772.2742 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	285.3006	0.5190	148.0710 (379)
Total CO2, kg/year			920.3452 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6500 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER	15.6500	ZC1
Total Floor Area	58.8000	TFA
Assumed number of occupants	1.9475	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	17.1234	ZC2
CO2 emissions from cooking, equation (L16)	2.8187	ZC3
Total CO2 emissions	35.5921	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	35.5921	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1279 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3779 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3212 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3613	0.3774 (22b)
	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
GF			58.8000	0.1300	7.6440		(28a)
Main Type 3	19.0300	8.4600	10.5700	0.1800	1.9026		(29a)
Corridor	19.0300	1.9500	17.0800	0.1800	3.0744		(29a)
Total net area of external elements Aum(A, m ²)			96.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.7869		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3601 (36)
Total fabric heat loss						(33) + (36) =	32.1470 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1353	29.9673	29.8025	29.0288	28.8840	28.2101	28.2101	28.0853	28.4697	28.8840	29.1769	29.4830 (38)
Heat transfer coeff	62.2823	62.1143	61.9495	61.1758	61.0310	60.3571	60.3571	60.2323	60.6167	61.0310	61.3239	61.6301 (39)
Average = Sum(39)m / 12 =												61.1751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0592	1.0564	1.0536	1.0404	1.0379	1.0265	1.0265	1.0244	1.0309	1.0379	1.0429	1.0481 (40)
HLP (average)												1.0404 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426 (64)
Heat gains from water heating, kWh/month	83.0318	73.7476	78.7778	72.4590	72.3400	66.5531	65.7385	69.6247	68.7149	75.0457	77.0398	81.6549 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	(71)
Water heating gains (Table 5)	111.6018	109.7434	105.8841	100.6375	97.2311	92.4349	88.3582	93.5815	95.4374	100.8678	106.9997	109.7511	(72)
Total internal gains	352.8800	350.9785	339.9966	322.4564	304.8795	287.8328	276.7082	281.9747	290.9531	308.6771	328.9795	343.9814	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
North				8.4600	10.6334	0.6300	0.7000	0.7700			27.4925 (74)	
Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191 (83)
Total gains	380.3725	403.5180	429.2741	465.8590	498.0560	494.6339	469.7834	435.1552	398.2937	371.2186	362.8950	366.9005 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.5617	65.7391	65.9139	66.7475	66.9059	67.6529	67.6529	67.7931	67.3632	66.9059	66.5863	66.2556	
alpha	5.3708	5.3826	5.3943	5.4498	5.4604	5.5102	5.5102	5.5195	5.4909	5.4604	5.4391	5.4170	
util living area	0.9971	0.9955	0.9902	0.9687	0.8947	0.7262	0.5544	0.6165	0.8658	0.9771	0.9945	0.9977	(86)
MIT	19.9268	20.0277	20.2307	20.5291	20.8011	20.9557	20.9917	20.9856	20.8802	20.5565	20.1993	19.9107	(87)
Th 2	20.0343	20.0366	20.0389	20.0498	20.0518	20.0613	20.0613	20.0631	20.0577	20.0518	20.0477	20.0434	(88)
util rest of house	0.9962	0.9940	0.9866	0.9566	0.8548	0.6408	0.4419	0.5011	0.8017	0.9659	0.9923	0.9969	(89)
MIT 2	18.6046	18.7536	19.0503	19.4854	19.8513	20.0310	20.0581	20.0569	19.9576	19.5305	19.0125	18.5878	(90)
Living area fraction	19.0329	19.1664	19.4327	19.8235	20.1590	20.3306	20.3606	20.3578	20.2565	19.8629	19.3970	19.0164	(91)
Temperature adjustment	19.0329	19.1664	19.4327	19.8235	20.1590	20.3306	20.3606	20.3578	20.2565	19.8629	19.3970	19.0164	(92)
adjusted MIT	19.0329	19.1664	19.4327	19.8235	20.1590	20.3306	20.3606	20.3578	20.2565	19.8629	19.3970	19.0164	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9948	0.9921	0.9837	0.9530	0.8600	0.6668	0.4786	0.5387	0.8171	0.9630	0.9902	0.9957	(94)
Ext temp.	378.3988	400.3123	422.2638	443.9720	428.3136	329.8302	224.8268	234.4170	325.4522	357.4907	359.3389	365.3245	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	917.6023	886.1447	801.1759	668.2551	516.2635	345.8844	226.9767	238.3858	373.1882	565.3257	754.0982	913.1365	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	401.1674	326.4793	281.9106	161.4838	65.4347	0.0000	0.0000	0.0000	0.0000	154.6293	284.2267	407.5721	(98)
Space heating per m2												2082.9039	(98)
												35.4235	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2227.7047 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	401.1674	326.4793	281.9106	161.4838	65.4347	0.0000	0.0000	0.0000	0.0000	154.6293	284.2267	407.5721	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	429.0560	349.1758	301.5087	172.7100	69.9837	0.0000	0.0000	0.0000	0.0000	165.3789	303.9857	435.9060	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426	(64)
Efficiency of water heater (217)m	86.8851	86.6889	86.1896	84.9944	82.7966	79.8000	79.8000	79.8000	79.8000	84.7824	86.2569	86.9779	(216)
Fuel for water heating, kWh/month	207.7269	183.7161	194.5590	177.5636	179.1474	166.8637	160.9947	175.6410	175.0112	184.5492	190.9368	202.7440	(219)
Water heating fuel used												2199.4536	(219)
Annual totals kWh/year													
Space heating fuel - main system													2227.7047 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													285.3006 (232)
Total delivered energy for all uses													4787.4589 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2227.7047	0.2160	481.1842 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2199.4536	0.2160	475.0820 (264)
Space and water heating			956.2662 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	285.3006	0.5190	148.0710 (268)
Total CO2, kg/m2/year			1143.2622 (272)
Emissions per m2 for space and water heating			16.2630 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5182 (272b)
Emissions per m2 for pumps and fans			0.6620 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2630 * 1.55) + 2.5182 + 0.6620, rounded to 2 d.p.			28.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-04			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 4, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	15.19	TER	27.50
Environmental	89 B	% DER<TER	44.77		
CO ₂ Emissions (t/year)	0.92	DFEE	47.52	TFEE	53.03
General Requirements Compliance	Pass	% DFEE<TFEE	10.39		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2041 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4541 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1200	9.5328	75.0000	5958.0000 (28a)
Main Type 3	48.6200	11.4900	37.1300	0.1700	6.3121	110.0000	4084.3000 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8851		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Ceilings 1			73.6900			30.0000	2210.7000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26487.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							359.4484 (35)
Thermal bridges (User defined value 0.075 * total exposed area)							9.9060 (36)
Total fabric heat loss							(33) + (36) = 43.7911 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	83.9656	83.6615	83.3634	81.9632	81.7012	80.4817	80.4817	80.2559	80.9515	81.7012	82.2312	82.7852 (39)
Average = Sum(39)m / 12 =												81.9620 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1353	1.1313	1.1123	1.1087	1.0922	1.0922	1.0891	1.0985	1.1087	1.1159	1.1234 (40)
HLP (average)												1.1123 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	187.1188	(64)
Heat gains from water heating, kWh/month													
85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	83.5268	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)													
114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672	112.2672	(72)
Total internal gains													
397.2998	395.2146	382.3461	361.6741	340.7663	320.6115	307.5281	313.3604	323.9979	344.8746	368.8175	386.6953	386.6953	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
North				9.7300	10.6334	0.6300	0.7000	0.7700			31.6196 (74)	
West				1.7600	19.6403	0.6300	0.7000	0.7700			10.5641 (80)	
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	439.4835	476.3069	519.0591	576.2395	623.7723	620.7277	588.8715	540.4603	487.0343	441.3262	420.9965	421.7423 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	87.6276	87.9462	88.2607	89.7684	90.0563	91.4208	91.4208	91.6781	90.8904	90.0563	89.4759	88.8770	
alpha	6.8418	6.8631	6.8840	6.9846	7.0038	7.0947	7.0947	7.1119	7.0594	7.0038	6.9651	6.9251	
util living area	0.9998	0.9995	0.9983	0.9904	0.9434	0.7816	0.5947	0.6680	0.9272	0.9951	0.9994	0.9998	(86)
MIT	20.0871	20.1738	20.3445	20.5993	20.8368	20.9714	20.9963	20.9922	20.8980	20.6091	20.3130	20.0791	(87)
Th 2	19.9688	19.9721	19.9754	19.9908	19.9937	20.0072	20.0072	20.0097	20.0020	19.9937	19.9879	19.9817	(88)
util rest of house	0.9996	0.9992	0.9973	0.9844	0.9082	0.6832	0.4646	0.5331	0.8674	0.9911	0.9990	0.9997	(89)
MIT 2	18.7518	18.8813	19.1333	19.5144	19.8388	19.9917	20.0063	20.0075	19.9247	19.5334	19.0974	18.7503	(90)
Living area fraction									fLA = Living area / (4) =			0.2679	(91)
MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1095	19.2276	19.4578	19.8051	20.1061	20.2542	20.2715	20.2713	20.1855	19.8216	19.4230	19.1062	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9995	0.9989	0.9966	0.9829	0.9129	0.7096	0.4999	0.5700	0.8809	0.9901	0.9987	0.9996	(94)
Useful gains	439.2527	475.7970	517.3173	566.4020	569.4669	440.4527	294.3813	308.0884	429.0103	436.9483	420.4539	421.5784	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
1243.4886	1198.6645	1080.2050	893.8141	686.7907	455.0570	295.4902	310.6935	492.6264	753.4136	1013.3356	1234.0161	1234.0161	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
598.3515	485.7669	418.7885	235.7366	87.2889	0.0000	0.0000	0.0000	0.0000	235.4502	426.8748	604.4536	604.4536	(98)
Space heating												3092.7111	(98)
Space heating per m2												(98) / (4) =	41.9692 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	3092.7111	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3247.3466	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1946.3205	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365	(310a)
Electricity used for heat distribution	52.9098	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	339.7119	(332)
Total delivered energy for all uses	5630.6950	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1763.6610	0.5190	915.3401 (367)
Electrical energy for heat distribution	52.9098	0.5190	27.4602 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			942.8003 (373)
Space and water heating			942.8003 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total CO2, kg/year			1119.1108 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1900 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.1900	ZC1
Total Floor Area	TFA	73.6900	
Assumed number of occupants	N	2.3323	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5455	ZC2
CO2 emissions from cooking, equation (L16)		2.3745	ZC3
Total CO2 emissions		34.1100	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1100	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
Total net area of external elements Aum(A, m ²)			132.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5662		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4323 (36)
Total fabric heat loss						(33) + (36) =	42.9985 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	81.5119	81.2723	81.0374	79.9342	79.7278	78.7669	78.7669	78.5890	79.1370	79.7278	80.1453	80.5819 (39)
Average = Sum(39)m / 12 =												79.9332 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1061	1.1029	1.0997	1.0847	1.0819	1.0689	1.0689	1.0665	1.0739	1.0819	1.0876	1.0935 (40)
HLP (average)												1.0847 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (64)
Heat gains from water heating, kWh/month	87.9883	78.0826	83.2511	76.3590	76.0821	69.7823	68.7308	73.0584	72.1896	79.0951	81.4601	86.4550 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	118.2639	116.1943	111.8967	106.0541	102.2609	96.9198	92.3801	98.1967	100.2634	106.3106	113.1390	116.2030 (72)
Total internal gains	404.2356	402.1504	389.2819	368.6099	347.7021	327.5473	314.4638	320.2962	330.9337	351.8104	375.7533	393.6310 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				9.7300	10.6334	0.6300	0.7000	0.7700	31.6196 (74)			
West				1.7600	19.6403	0.6300	0.7000	0.7700	10.5641 (80)			

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	446.4193	483.2427	525.9949	583.1753	630.7080	627.6635	595.8073	547.3961	493.9701	448.2619	427.9323	428.6781 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	62.7805	62.9656	63.1481	64.0197	64.1854	64.9684	64.9684	65.1155	64.6646	64.1854	63.8510	63.5051
alpha	5.1854	5.1977	5.2099	5.2680	5.2790	5.3312	5.3312	5.3410	5.3110	5.2790	5.2567	5.2337
util living area	0.9979	0.9964	0.9916	0.9712	0.9003	0.7377	0.5677	0.6341	0.8805	0.9817	0.9960	0.9983 (86)
MIT	19.8235	19.9369	20.1594	20.4830	20.7759	20.9468	20.9892	20.9813	20.8564	20.4979	20.1133	19.8078 (87)
Th 2	19.9958	19.9985	20.0011	20.0133	20.0156	20.0263	20.0263	20.0283	20.0222	20.0156	20.0110	20.0061 (88)
util rest of house	0.9972	0.9952	0.9884	0.9597	0.8610	0.6503	0.4493	0.5131	0.8186	0.9724	0.9943	0.9978 (89)
MIT 2	18.4261	18.5936	18.9194	19.3924	19.7888	19.9898	20.0222	20.0202	19.9005	19.4206	18.8606	18.4106 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8004	18.9534	19.2516	19.6846	20.0533	20.2462	20.2812	20.2777	20.1566	19.7092	19.1962	18.7849 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	444.6323	480.0385	518.2187	556.8291	544.1144	421.4517	286.7243	298.6791	409.2983	434.1455	424.6654	427.2866 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1181.9570	1142.1556	1033.3535	862.0562	665.9875	444.7314	289.9592	304.7430	479.2983	726.2577	969.4542	1175.2769 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048 (98)
Space heating												2853.2938 (98)
Space heating per m2										(98) / (4) =		38.7202 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3051.6511 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.5696	444.9427	383.2603	219.7635	90.6736	0.0000	0.0000	0.0000	0.0000	217.3314	392.2479	556.5048	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	586.7054	475.8746	409.9041	235.0412	96.9771	0.0000	0.0000	0.0000	0.0000	232.4400	419.5165	595.1923	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791	(64)
Efficiency of water heater (217)m	87.4214	87.2349	86.7661	85.6173	83.3715	79.8000	79.8000	79.8000	79.8000	85.4914	86.8645	79.8000	(216)
Fuel for water heating, kWh/month	223.5043	197.5118	208.7721	189.9715	191.4112	179.0338	172.2722	188.5820	188.1068	197.2644	204.9055	218.0218	(219)
Water heating fuel used												2359.3574	(219)
Annual totals kWh/year													
Space heating fuel - main system												3051.6511	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												339.7119	(232)
Total delivered energy for all uses												5825.7204	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3051.6511	0.2160	659.1566 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2359.3574	0.2160	509.6212 (264)
Space and water heating			1168.7778 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1384.0133 (272)
Emissions per m2 for space and water heating			15.8607 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8607 * 1.55) + 2.3926 + 0.5282, rounded to 2 d.p.			27.5000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-05			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT GF		
Property	Plot 5, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	14.03	TER	25.54
Environmental	89 B	% DER<TER	45.06		
CO ₂ Emissions (t/year)	0.92	DFEE	43.35	TFEE	48.63
General Requirements Compliance	Pass	% DFEE<TFEE	10.86		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272	75.0000	5958.0000 (28a)
Main Type 3	53.9800	13.9300	40.0500	0.1700	6.8085	110.0000	4405.5000 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.8758		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Ceilings 1			79.4400			30.0000	2383.2000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26557.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							334.3108 (35)
Thermal bridges (User defined value 0.067 * total exposed area)							10.5337 (36)
Total fabric heat loss						(33) + (36) =	53.4095 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	96.1784	95.8716	95.5708	94.1579	93.8936	92.6631	92.6631	92.4352	93.1371	93.8936	94.4284	94.9874 (39)
Average = Sum(39)m / 12 =												94.1567 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2107	1.2068	1.2031	1.1853	1.1819	1.1665	1.1665	1.1636	1.1724	1.1819	1.1887	1.1957 (40)
HLP (average)												1.1853 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												

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Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)
Temperature factor from Table 2b													0.6000 (49)
Enter (49) or (54) in (55)													0.7200 (55)
Total storage loss													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(56)
If cylinder contains dedicated solar storage													
22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	21.6000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													(63)
Output from w/h													
196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	191.6165	(64)
Heat gains from water heating, kWh/month													
86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	85.0223	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148	20.5148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)													
116.4036	114.2683	109.8341	103.8059	99.8921	94.3813	89.6973	95.6988	97.8311	104.0705	111.1159	114.2772	114.2772	(72)
Total internal gains													
414.4121	412.3100	398.8576	377.1761	355.1684	333.9712	320.2115	326.1798	337.3303	359.2229	384.3622	403.2100	403.2100	(73)

6. Solar gains

[Jan]													
Area	m2												
Solar flux	Table 6a												
Specific data	g												
Specific data	or Table 6b												
FF	or Table 6c												
Access	factor												
Table 6d													
Gains	W												
East	3.9900	19.6403	0.6300	0.7000	0.7700	23.9493	(76)						
Southeast	1.1100	36.7938	0.6300	0.7000	0.7700	12.4816	(77)						
South	7.7200	46.7521	0.6300	0.7000	0.7700	110.3037	(78)						
Southwest	1.1100	36.7938	0.6300	0.7000	0.7700	12.4816	(79)						
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705	(83)
Total gains	573.6282	682.3303	764.3071	821.8693	844.8364	816.1205	786.7302	759.9330	730.4432	656.6564	574.8717	539.5805	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	76.7025	76.9480	77.1902	78.3484	78.5690	79.6123	79.6123	79.8086	79.2072	78.5690	78.1240	77.6642	
alpha	6.1135	6.1299	6.1460	6.2232	6.2379	6.3075	6.3075	6.3206	6.2805	6.2379	6.2083	6.1776	
util living area	0.9988	0.9962	0.9883	0.9597	0.8757	0.6973	0.5143	0.5532	0.8018	0.9708	0.9967	0.9992	(86)
MIT	20.0439	20.2003	20.4160	20.6744	20.8760	20.9777	20.9971	20.9955	20.9470	20.6850	20.3135	20.0202	(87)
Th 2	19.9114	19.9145	19.9176	19.9318	19.9345	19.9469	19.9469	19.9492	19.9421	19.9345	19.9291	19.9234	(88)
util rest of house	0.9983	0.9946	0.9828	0.9404	0.8209	0.5966	0.3935	0.4305	0.7111	0.9527	0.9948	0.9988	(89)
MIT 2	18.6526	18.8828	19.1969	19.5702	19.8261	19.9352	19.9462	19.9480	19.9084	19.5931	19.0596	18.6270	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	19.0619	19.2704	19.5555	19.8951	20.1349	20.2419	20.2554	20.2561	20.2139	19.9144	19.4285	19.0368	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0619	19.2704	19.5555	19.8951	20.1349	20.2419	20.2554	20.2561	20.2139	19.9144	19.4285	19.0368	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9977	0.9932	0.9804	0.9396	0.8325	0.6262	0.4293	0.4670	0.7366	0.9523	0.9936	0.9984	0.9984	(94)
Useful gains	572.2844	677.6599	749.2906	772.2217	703.3268	511.0196	337.7667	354.8561	538.0381	625.3365	571.2064	538.6951	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1419.7798	1377.7137	1247.7277	1035.2717	791.9873	522.7960	338.7168	356.4434	569.4352	874.5585	1164.1594	1409.3116	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	630.5366	470.4361	370.8372	189.3960	65.9634	0.0000	0.0000	0.0000	0.0000	185.4212	426.9261	647.7387	(98)
Space heating												2987.2553	(98)
Space heating per m2										(98) / (4) =		37.6039	(99)

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8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2987.2553	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3136.6181	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1991.1144	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702	(310a)
Electricity used for heat distribution	52.2729	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	352.5010	(332)
Total delivered energy for all uses	5579.7893	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1742.4294	0.5190	904.3209 (367)
Electrical energy for heat distribution	52.2729	0.5190	27.1296 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			931.4505 (373)
Space and water heating			931.4505 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	352.5010	0.5190	182.9480 (379)
Total CO2, kg/year			1114.3985 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0300 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER	14.0300	ZC1
Total Floor Area	79.4400	TFA
Assumed number of occupants	2.4521	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.2815	ZC2
CO2 emissions from cooking, equation (L16)	2.2388	ZC3
Total CO2 emissions	32.5503	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	32.5503	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.9300	1.3258	18.4678		(27)
GF			79.4400	0.1300	10.3272		(28a)
Main Type 3	53.9800	13.9300	40.0500	0.1800	7.2090		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
Total net area of external elements Aum(A, m ²)			157.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8870		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2826 (36)
Total fabric heat loss						(33) + (36) =	52.1696 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	93.3276	93.0833	92.8438	91.7190	91.5085	90.5288	90.5288	90.3474	90.9062	91.5085	91.9342	92.3793 (39)
Average = Sum(39)m / 12 =												91.7179 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1748	1.1717	1.1687	1.1546	1.1519	1.1396	1.1396	1.1373	1.1443	1.1519	1.1573	1.1629 (40)
HLP (average)												1.1546 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

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Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Heat gains from water heating, kWh/month	89.5325	79.4331	84.6448	77.5740	77.2479	70.7883	69.6630	74.1281	73.2722	80.3567	82.8372	87.9505 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9601	17.7284	14.4177	10.9151	8.1592	6.8883	7.4431	9.6748	12.9855	16.4880	19.2440	20.5148 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (69)	
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)	
Water heating gains (Table 5)	120.3394	118.2041	113.7699	107.7416	103.8279	98.3171	93.6331	99.6346	101.7669	108.0063	115.0517	118.2130 (72)	
Total internal gains	421.3479	419.2458	405.7933	384.1119	362.1042	340.9070	327.1473	333.1155	344.2661	366.1587	391.2980	410.1457 (73)	

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				3.9900	19.6403	0.6300	0.7000	0.7700	23.9493 (76)			
Southeast				1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (77)			
South				7.7200	46.7521	0.6300	0.7000	0.7700	110.3037 (78)			
Southwest				1.1100	36.7938	0.6300	0.7000	0.7700	12.4816 (79)			
Solar gains	159.2161	270.0203	365.4495	444.6932	489.6679	482.1493	466.5187	433.7532	393.1129	297.4335	190.5095	136.3705 (83)
Total gains	580.5640	689.2661	771.2429	828.8051	851.7721	823.0563	793.6659	766.8688	737.3790	663.5922	581.8075	546.5162 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1108	59.2659	59.4188	60.1475	60.2858	60.9382	60.9382	61.0606	60.6853	60.2858	60.0067	59.7175	
alpha	4.9407	4.9511	4.9613	5.0098	5.0191	5.0625	5.0625	5.0707	5.0457	5.0191	5.0004	4.9812	
util living area	0.9952	0.9883	0.9721	0.9291	0.8335	0.6639	0.4941	0.5306	0.7606	0.9441	0.9893	0.9964 (86)	
MIT	19.8457	20.0374	20.2972	20.5987	20.8333	20.9610	20.9927	20.9897	20.9214	20.6157	20.1708	19.8118 (87)	
Th 2	19.9402	19.9427	19.9451	19.9565	19.9587	19.9686	19.9686	19.9705	19.9648	19.9587	19.9543	19.9498 (88)	
util rest of house	0.9936	0.9846	0.9628	0.9054	0.7803	0.5730	0.3824	0.4176	0.6777	0.9202	0.9851	0.9952 (89)	
MIT 2	18.4185	18.6981	19.0724	19.5002	19.8010	19.9436	19.9661	19.9664	19.9068	19.5333	18.9019	18.3760 (90)	
Living area fraction									fLA = Living area / (4) =			0.2942 (91)	
MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8384	19.0921	19.4327	19.8234	20.1047	20.2429	20.2681	20.2675	20.2053	19.8517	19.2752	18.7984 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	575.5217	675.8279	738.2004	747.3967	671.7008	492.5046	329.7105	345.8511	515.1166	608.6683	570.9964	542.8863 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	1356.8294	1321.0514	1200.7221	1001.8805	769.1006	510.8468	332.0674	349.4146	555.0081	846.6104	1119.3159	1348.5884 (97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating kWh	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424 (98)	
Space heating												2785.9543 (98)	
Space heating per m2										(98) / (4) =		35.0699 (99)	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2979.6303 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	581.2929	433.5901	344.1162	183.2283	72.4654	0.0000	0.0000	0.0000	0.0000	177.0290	394.7900	599.4424 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	621.7037	463.7328	368.0387	195.9661	77.5031	0.0000	0.0000	0.0000	0.0000	189.3358	422.2353	641.1148 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Efficiency of water heater (217)m	87.4964	87.1223	86.4427	85.0727	82.8121	79.8000	79.8000	79.8000	79.8000	84.8839	86.8247	79.8000 (216)
Fuel for water heating, kWh/month	228.6206	202.4291	214.4020	195.4830	196.9382	182.8254	175.7856	192.6138	192.1866	203.1461	209.7697	87.6134 (217)
Water heating fuel used												222.8846 (219)
Annual totals kWh/year												2417.0847 (219)
Space heating fuel - main system												2979.6303 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												352.5010 (232)
Total delivered energy for all uses												5824.2161 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2979.6303	0.2160	643.6001 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2417.0847	0.2160	522.0903 (264)
Space and water heating			1165.6904 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	352.5010	0.5190	182.9480 (268)
Total CO2, kg/m2/year			1387.5635 (272)
Emissions per m2 for space and water heating			14.6738 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3030 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6738 * 1.55) + 2.3030 + 0.4900, rounded to 2 d.p.			25.5400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-06			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Mid		
Property	Plot 6, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	13.91	TER	24.52
Environmental	89 B	% DER<TER	43.28		
CO ₂ Emissions (t/year)	0.93	DFEE	42.60	TFEE	44.96
General Requirements Compliance	Pass	% DFEE<TFEE	5.25		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum (m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 16.1445 (36)
Total fabric heat loss (33) + (36) = 51.2907 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	94.0596	93.7527	93.4519	92.0391	91.7748	90.5443	90.5443	90.3164	91.0182	91.7748	92.3095	92.8686 (39)
Average = Sum(39)m / 12 =												92.0379 (39)
HLP	Jan 1.1840	Feb 1.1802	Mar 1.1764	Apr 1.1586	May 1.1553	Jun 1.1398	Jul 1.1398	Aug 1.1369	Sep 1.1457	Oct 1.1553	Nov 1.1620	Dec 1.1690 (40)
HLP (average)												1.1586 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	Jan 101.6824	Feb 97.9849	Mar 94.2873	Apr 90.5898	May 86.8922	Jun 83.1947	Jul 83.1947	Aug 86.8922	Sep 90.5898	Oct 94.2873	Nov 97.9849	Dec 101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

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Water storage loss:													
Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.7200 (55)	
Total storage loss													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)
If cylinder contains dedicated solar storage													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(57)
Primary loss													
	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(62)
Solar input												0.0000 (63)	
												0.0000	
												0.0000	
												0.0000	
												0.0000	
Solar input (sum of months) = Sum (63)m =												0.0000 (63)	
Output from w/h													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(64)
Total per year (kWh/year) = Sum (64)m =												1991.1144 (64)	
Heat gains from water heating, kWh/month													
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9913	0.9815	0.9608	0.9115	0.8085	0.6246	0.4382	0.4745	0.7222	0.9245	0.9821	0.9933 (94)
Useful gains	555.4431	647.5710	705.4083	716.3991	651.5141	485.8958	328.5260	344.0477	504.3528	584.2013	548.9276	524.6386 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1358.4612	1321.2170	1199.7994	998.8769	767.5998	509.9799	331.9424	349.0788	553.9253	843.7998	1116.9503	1347.5856 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	597.4455	452.6902	367.8270	203.3841	86.3677	0.0000	0.0000	0.0000	0.0000	193.1413	408.9764	612.2726 (98)
Space heating												2922.1047 (98)
Space heating per m2												36.7838 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2922.1047	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3068.2099	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1991.1144	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702	(310a)
Electricity used for heat distribution	51.5888	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	357.9139	(332)
Total delivered energy for all uses	5516.7940	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1719.6267	0.5190	892.4863 (367)
Electrical energy for heat distribution	51.5888	0.5190	26.7746 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			919.2608 (373)
Space and water heating			919.2608 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	357.9139	0.5190	185.7573 (379)
Total CO2, kg/year			1105.0182 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9100 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9100	ZC1
Total Floor Area	TFA	79.4400	
Assumed number of occupants	N	2.4521	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2815	ZC2
CO2 emissions from cooking, equation (L16)		2.2388	ZC3
Total CO2 emissions		32.4303	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4303	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1800	7.4088		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
PIJ	29.8500		29.8500	0.1300	3.8805		(30)
Total net area of external elements Aum(A, m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1685		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1105 (36)
Total fabric heat loss							(33) + (36) = 46.2790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	87.4370	87.1927	86.9532	85.8284	85.6179	84.6382	84.6382	84.4568	85.0156	85.6179	86.0436	86.4887 (39)
Average = Sum(39)m / 12 =												85.8274 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1007	1.0976	1.0946	1.0804	1.0778	1.0654	1.0654	1.0632	1.0702	1.0778	1.0831	1.0887 (40)
HLP (average)												1.0804 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy content (annual)	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1454.4184 (45)
Water storage loss:	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Heat gains from water heating, kWh/month	89.5325	79.4331	84.6448	77.5740	77.2479	70.7883	69.6630	74.1281	73.2722	80.3567	82.8372	87.9505 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860 (71)
Water heating gains (Table 5)	120.3394	118.2041	113.7699	107.7416	103.8279	98.3171	93.6331	99.6346	101.7669	108.0063	115.0517	118.2130 (72)
Total internal gains	421.6544	419.5180	406.0147	384.2795	362.2295	341.0128	327.2616	333.2641	344.4655	366.4119	391.5935	410.4608 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c		Access factor Table 6d	Gains W		
Southeast				1.0000	36.7938	0.6300	0.7000		0.7700	11.2447 (77)		
South				7.0200	46.7521	0.6300	0.7000		0.7700	100.3020 (78)		
Southwest				1.0000	36.7938	0.6300	0.7000		0.7700	11.2447 (79)		
West				3.8000	19.6403	0.6300	0.7000		0.7700	22.8088 (80)		
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	398.7971	360.8006	272.4616	174.2691	124.6732 (83)
Total gains	567.2546	666.7134	741.1593	792.8881	812.7546	784.8465	756.6147	732.0612	705.2661	638.8735	565.8626	535.1340 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0931	63.2699	63.4441	64.2756	64.4336	65.1794	65.1794	65.3194	64.8901	64.4336	64.1147	63.7848	
alpha	5.2062	5.2180	5.2296	5.2850	5.2956	5.3453	5.3453	5.3546	5.3260	5.2956	5.2743	5.2523	
util living area	0.9955	0.9891	0.9734	0.9304	0.8324	0.6576	0.4865	0.5222	0.7555	0.9444	0.9897	0.9967 (86)	
MIT	19.9317	20.1115	20.3559	20.6398	20.8566	20.9693	20.9948	20.9925	20.9355	20.6561	20.2389	19.9005 (87)	
Th 2	20.0003	20.0028	20.0053	20.0169	20.0190	20.0292	20.0292	20.0310	20.0253	20.0190	20.0146	20.0100 (88)	
util rest of house	0.9941	0.9856	0.9648	0.9076	0.7809	0.5711	0.3822	0.4166	0.6757	0.9213	0.9858	0.9956 (89)	
MIT 2	18.5870	18.8495	19.2019	19.6056	19.8829	20.0093	20.0273	20.0281	19.9774	19.6368	19.0446	18.5486 (90)	
Living area fraction									fLA = Living area / (4) =			0.2942 (91)	
MIT	18.9826	19.2207	19.5414	19.9098	20.1694	20.2918	20.3119	20.3118	20.2593	19.9367	19.3960	18.9463 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.9826	19.2207	19.5414	19.9098	20.1694	20.2918	20.3119	20.3118	20.2593	19.9367	19.3960	18.9463 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9920	0.9820	0.9597	0.9047	0.7896	0.5955	0.4130	0.4478	0.6963	0.9190	0.9825	0.9939 (94)
Useful gains	562.7201	654.7098	711.2740	717.3242	641.7339	467.3963	312.4890	327.8008	491.0742	587.1014	555.9645	531.8753 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1283.8004	1248.6634	1133.9881	944.9567	725.1286	481.7396	314.1695	330.3765	523.6351	799.3868	1057.9891	1275.3862 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	536.4837	399.1368	314.4993	163.8954	62.0456	0.0000	0.0000	0.0000	0.0000	157.9404	361.4577	553.1721 (98)
Space heating												2548.6311 (98)
Space heating per m2										(98) / (4) =		32.0825 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2725.8086 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	536.4837	399.1368	314.4993	163.8954	62.0456	0.0000	0.0000	0.0000	0.0000	157.9404	361.4577	553.1721 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	573.7794	426.8843	336.3629	175.2892	66.3590	0.0000	0.0000	0.0000	0.0000	168.9202	386.5858	591.6279 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Efficiency of water heater (217)m	87.3201	86.9281	86.2136	84.7750	82.4878	79.8000	79.8000	79.8000	79.8000	84.5807	86.6090	79.8000 (216)
Fuel for water heating, kWh/month	229.0822	202.8814	214.9716	196.1694	197.7125	182.8254	175.7856	192.6138	192.1866	203.8744	210.2921	223.3241 (219)
Water heating fuel used												2421.7191 (219)
Annual totals kWh/year												
Space heating fuel - main system												2725.8086 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												357.9139 (232)
Total delivered energy for all uses												5580.4417 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2725.8086	0.2160	588.7747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2421.7191	0.2160	523.0913 (264)
Space and water heating			1111.8660 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	357.9139	0.5190	185.7573 (268)
Total CO2, kg/m2/year			1336.5483 (272)
Emissions per m2 for space and water heating			13.9963 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3383 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9963 * 1.55) + 2.3383 + 0.4900, rounded to 2 d.p.			24.5200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-07			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Mid		
Property	Plot 7, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	14.44	TER	26.08
Environmental	89 B	% DER<TER	44.64		
CO ₂ Emissions (t/year)	0.88	DFEE	43.72	TFEE	48.23
General Requirements Compliance	Pass	% DFEE<TFEE	9.35		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.2041 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4541 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1700	6.3121	9.0000	334.1700 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
PIJ	27.8100		27.8100	0.1300	3.6153	9.0000	250.2900 (30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	27.9676			(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Floor 1			73.6900			30.0000	2210.7000 (32d)
Party Ceilings 1			45.8800			30.0000	1376.4000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (User defined value 0.150 * total exposed area)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	18406.3100 (34)
	249.7803 (35)
	12.0675 (36)
(33) + (36) =	40.0351 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	40.1745
Heat transfer coeff	80.2096
Average = Sum(39)m / 12 =	
HLP	1.0885
HLP (average)	1.0843
Days in month	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3323 (42)
Average daily hot water use (litres/day)		89.5916 (43)
Daily hot water use	98.5507	94.9671
Energy conte	146.1479	127.8219
Energy content (annual)	131.9007	114.9943
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733
	19.7851	17.2491
	16.5510	14.2822
	13.2346	15.1869
	15.3682	17.9102
	19.5504	21.2305 (46)

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Water storage loss:													
Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.7200 (55)	
Total storage loss													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)
If cylinder contains dedicated solar storage													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum (63)m =					0.0000 (63)
Output from w/h	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(64)
								Total per year (kWh/year) = Sum (64)m =					1946.3205 (64)
Heat gains from water heating, kWh/month													
	85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	9.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672 (72)
Total internal gains	397.2998	395.2146	382.3461	361.6741	340.7663	320.6115	307.5281	313.3604	323.9979	344.8746	368.8175	386.6953 (73)

[Jan				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				9.7300	10.6334	0.6300	0.7000	0.7700	31.6196			
West				1.7600	19.6403	0.6300	0.7000	0.7700	10.5641 (84)			
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	439.4835	476.3069	519.0591	576.2395	623.7723	620.7277	588.8715	540.4603	487.0343	441.3262	420.9965	421.7423 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil/m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	63.7438	63.9864	64.2260	65.3759	65.5956	66.6382	66.6382	66.8349	66.2327	65.5956	65.1526	64.6958
alpha	5.2496	5.2658	5.2817	5.3584	5.3730	5.4425	5.4425	5.4557	5.4155	5.3730	5.3435	5.3131
util living area	0.9981	0.9966	0.9919	0.9714	0.8990	0.7318	0.5611	0.6278	0.8793	0.9823	0.9962	0.9985 (86)
MIT	19.8380	19.9522	20.1740	20.4989	20.7871	20.9521	20.9907	20.9836	20.8643	20.5108	20.1302	19.8272 (87)
Th 2	20.0103	20.0136	20.0170	20.0326	20.0355	20.0491	20.0491	20.0517	20.0439	20.0355	20.0296	20.0234 (88)
util rest of house	0.9974	0.9955	0.9889	0.9601	0.8597	0.6458	0.4462	0.5100	0.8179	0.9732	0.9947	0.9979 (89)
MIT 2	18.4578	18.6269	18.9522	19.4299	19.8200	20.0163	20.0456	20.0445	19.9287	19.4543	18.8989	18.4515 (90)
Living area fraction									fLA = Living area / (4) =			0.2679 (91)
MIT	18.8276	18.9819	19.2795	19.7163	20.0791	20.2670	20.2987	20.2961	20.1794	19.7373	19.2288	18.8200 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8276	18.9819	19.2795	19.7163	20.0791	20.2670	20.2987	20.2961	20.1794	19.7373	19.2288	18.8200 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9963	0.9937	0.9858	0.9554	0.8618	0.6669	0.4772	0.5416	0.8281	0.9695	0.9928	0.9970 (94)
Useful gains	437.8421	473.3225	511.6797	550.5164	537.5644	413.9368	280.9956	292.7380	403.2907	427.8603	417.9760	420.4744 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1165.2496	1125.2203	1017.3418	845.9092	653.1078	434.8041	283.7876	298.0511	469.2986	712.2072	951.8072	1155.4061 (97)
Month fracti	1.0000	1.0000		1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	541.1912	438.0753	376.2126	212.6828	85.9643	0.0000	0.0000	0.0000	0.0000	211.5541	384.3585	546.7892 (98)
Space heating												2796.8280 (98)
Space heating per m2												37.9540 (99)
										(98) / (4) =		

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2796.8280 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2936.6694 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1946.3205 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365 (310a)
Electricity used for heat distribution	49.8031 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	339.7119 (332)
Total delivered energy for all uses	5320.0178 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1660.1020	0.5190	861.5929 (367)
Electrical energy for heat distribution	49.8031	0.5190	25.8478 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			887.4407 (373)
Space and water heating			887.4407 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total CO2, kg/year			1063.7512 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4400 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER	14.4400 ZC1
Total Floor Area	73.6900
Assumed number of occupants	2.3323
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190
CO2 emissions from appliances, equation (L14)	16.5455 ZC2
CO2 emissions from cooking, equation (L16)	2.3745 ZC3
Total CO2 emissions	33.3600 ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000 ZC7
Net CO2 emissions	33.3600 ZC8

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
PIJ	27.8100		27.8100	0.1300	3.6153		(30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8543		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8613 (36)
Total fabric heat loss						(33) + (36) =	37.7156 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	76.2290	75.9894	75.7545	74.6513	74.4449	73.4840	73.4840	73.3061	73.8541	74.4449	74.8624	75.2990 (39)
Average = Sum(39)m / 12 =												74.6503 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0345	1.0312	1.0280	1.0130	1.0102	0.9972	0.9972	0.9948	1.0022	1.0102	1.0159	1.0218 (40)
HLP (average)												1.0130 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

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Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (64)
Heat gains from water heating, kWh/month	87.9883	78.0826	83.2511	76.3590	76.0821	69.7823	68.7308	73.0584	72.1896	79.0951	81.4601	86.4550 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)	118.2639	116.1943	111.8967	106.0541	102.2609	96.9198	92.3801	98.1967	100.2634	106.3106	113.1390	116.2030	(72)
Total internal gains	404.2356	402.1504	389.2819	368.6099	347.7021	327.5473	314.4638	320.2962	330.9337	351.8104	375.7533	393.6310	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d				Gains W
North				9.7300	10.6334	0.6300	0.7000	0.7700				31.6196 (74)
West				1.7600	19.6403	0.6300	0.7000	0.7700				10.5641 (80)

Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	446.4193	483.2427	525.9949	583.1753	630.7080	627.6635	595.8073	547.3961	493.9701	448.2619	427.9323	428.6781 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1314	67.3431	67.5519	68.5502	68.7403	69.6391	69.6391	69.8082	69.2901	68.7403	68.3569	67.9606	
alpha	5.4754	5.4895	5.5035	5.5700	5.5827	5.6426	5.6426	5.6539	5.6193	5.5827	5.5571	5.5307	
util living area	0.9979	0.9963	0.9909	0.9672	0.8847	0.7061	0.5347	0.6001	0.8618	0.9795	0.9958	0.9983	(86)
MIT	19.9226	20.0335	20.2476	20.5566	20.8243	20.9644	20.9937	20.9886	20.8901	20.5617	20.1973	19.9077	(87)
Th 2	20.0547	20.0574	20.0601	20.0725	20.0748	20.0857	20.0857	20.0877	20.0815	20.0748	20.0701	20.0652	(88)
util rest of house	0.9972	0.9951	0.9876	0.9547	0.8431	0.6223	0.4278	0.4892	0.7978	0.9694	0.9941	0.9978	(89)
MIT 2	18.6136	18.7773	19.0907	19.5416	19.8992	20.0616	20.0833	20.0828	19.9900	19.5561	19.0262	18.5994	(90)
Living area fraction	18.9643	19.1138	19.4006	19.8135	20.1470	20.3035	20.3272	20.3254	20.2311	19.8255	19.3399	18.9499	(91)
MIT	18.9643	19.1138	19.4006	19.8135	20.1470	20.3035	20.3272	20.3254	20.2311	19.8255	19.3399	18.9499	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9643	19.1138	19.4006	19.8135	20.1470	20.3035	20.3272	20.3254	20.2311	19.8255	19.3399	18.9499	(93)

8. Space heating requirement

Utilisation	0.9960	0.9933	0.9845	0.9503	0.8468	0.6433	0.4566	0.5190	0.8097	0.9659	0.9922	0.9968	(94)
Useful gains	444.6541	479.9959	517.8182	554.2143	534.0981	403.8072	272.0323	284.1076	399.9538	432.9573	424.5943	427.3150	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1117.8416	1080.0964	977.2776	814.7075	628.8360	419.1143	273.8864	287.7564	452.8088	686.7917	916.3093	1110.6505	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	500.8515	403.2675	341.8378	187.5551	70.4851	0.0000	0.0000	0.0000	0.0000	188.8528	354.0348	508.4016	(98)
Space heating												2555.2862	(98)
Space heating per m2												(98) / (4) =	34.6762 (99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2732.9264 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	500.8515	403.2675	341.8378	187.5551	70.4851	0.0000	0.0000	0.0000	0.0000	188.8528	354.0348	508.4016	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	535.6700	431.3021	365.6020	200.5937	75.3851	0.0000	0.0000	0.0000	0.0000	201.9816	378.6468	543.7451	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791	(64)
Efficiency of water heater (217)m	87.2181	87.0076	86.4835	85.1946	82.7992	79.8000	79.8000	79.8000	79.8000	85.1162	86.6146	79.8000	(216)
Fuel for water heating, kWh/month	224.0254	198.0277	209.4544	190.9142	192.7343	179.0338	172.2722	188.5820	188.1068	198.1340	205.4968	218.5183	(219)
Water heating fuel used												2365.2998	(219)
Annual totals kWh/year													
Space heating fuel - main system												2732.9264	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												339.7119	(232)
Total delivered energy for all uses												5512.9381	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2732.9264	0.2160	590.3121 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2365.2998	0.2160	510.9048 (264)
Space and water heating			1101.2169 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1316.4523 (272)
Emissions per m2 for space and water heating			14.9439 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9439 * 1.55) + 2.3926 + 0.5282, rounded to 2 d.p.			26.0800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-08			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Mid		
Property	Plot 8, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	14.60	TER	26.05
Environmental	90 B	% DER<TER	43.94		
CO ₂ Emissions (t/year)	0.71	DFEE	40.08	TFEE	42.16
General Requirements Compliance	Pass	% DFEE<TFEE	4.96		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1918 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4418 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4788	0.4694	0.4600	0.4131	0.4037	0.3568	0.3568	0.3474	0.3755	0.4037	0.4225	0.4413 (22b)
Effective ac	0.6146	0.6102	0.6058	0.5853	0.5815	0.5636	0.5636	0.5603	0.5705	0.5815	0.5892	0.5974 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
Main Type 4	19.0300	8.4600	10.5700	0.1700	1.7969	9.0000	95.1300 (29a)
Corridor	19.0300	1.9500	17.0800	0.2257	3.8555	110.0000	1878.8000 (29a)
PIJ	13.7000		13.7000	0.1300	1.7810	9.0000	123.3000 (30)
Total net area of external elements Aum(A, m ²)			51.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.9893		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Floor 1			58.8000			30.0000	1764.0000 (32d)
Party Ceilings 1			45.1000			30.0000	1353.0000 (32b)
Internal Wall 1			114.2100			75.0000	8565.7500 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14671.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		249.5201 (35)
Thermal bridges (User defined value 0.150 * total exposed area)		7.7640 (36)
Total fabric heat loss	(33) + (36) =	28.7533 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	31.7238	31.4941	31.2689	30.2111	30.0132	29.0920	29.0920	28.9214	29.4468	30.0132	30.4136	30.8321 (38)
Average = Sum(39)m / 12 =	60.4772	60.2474	60.0222	58.9645	58.7666	57.8453	57.8453	57.6747	58.2002	58.7666	59.1669	59.5855 (39)
												58.9635 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0285	1.0246	1.0208	1.0028	0.9994	0.9838	0.9838	0.9809	0.9898	0.9994	1.0062	1.0134 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy content (annual)	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)

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Water storage loss:													180.0000	(47)
Store volume														
a) If manufacturer declared loss factor is known (kWh/day):													1.2000	(48)
Temperature factor from Table 2b													0.6000	(49)
Enter (49) or (54) in (55)													0.7200	(55)
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200		(56)
If cylinder contains dedicated solar storage	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200		(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624		(59)
Total heat required for water heating calculated for each month														
	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823		(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63)
								Solar input (sum of months) = Sum(63)m =				0.0000		(63)
Output from w/h	176.8234	155.9554	164.0294	147.3770	144.6676	129.6150	124.8135	136.5013	136.1167	152.8050	161.1539	172.6823		(64)
								Total per year (kWh/year) = Sum(64)m =				1802.5405		(64)
Heat gains from water heating, kWh/month														
	80.1036	71.1027	75.8496	69.6252	69.4118	63.7194	62.8103	66.6964	65.8812	72.1174	74.2060	78.7266		(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004 (71)
Water heating gains (Table 5)	107.6661	105.8076	101.9483	96.7017	93.2954	88.4991	84.4224	89.6458	91.5016	96.9320	103.0639	105.8154 (72)
Total internal gains	345.9443	344.0427	333.0608	315.5206	297.9438	280.8970	269.7724	275.0389	284.0174	301.7414	322.0438	337.0457 (73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					8.4600	10.6334	0.6300	0.7000	0.7700		27.4925 (74)	
Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191 (83)
Total gains	373.4368	396.5822	422.3384	458.9232	491.1202	487.6981	462.8477	428.2195	391.3579	364.2828	355.9593	359.9648 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil _m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	67.3890	67.6460	67.8998	69.1178	69.3505	70.4550	70.4550	70.6634	70.0255	69.3505	68.8813	68.3975
alpha	5.4926	5.5097	5.5267	5.6079	5.6234	5.6970	5.6970	5.7109	5.6684	5.6234	5.5921	5.5598
util living area	0.9973	0.9957	0.9905	0.9682	0.8905	0.7139	0.5415	0.6036	0.8608	0.9773	0.9947	0.9978 (86)
MIT	19.9571	20.0585	20.2595	20.5576	20.8204	20.9637	20.9936	20.9887	20.8934	20.5803	20.2307	19.9470 (87)
Th 2	20.0596	20.0629	20.0660	20.0810	20.0838	20.0969	20.0969	20.0993	20.0918	20.0838	20.0781	20.0722 (88)
util rest of house	0.9965	0.9943	0.9870	0.9561	0.8504	0.6309	0.4348	0.4935	0.7970	0.9663	0.9927	0.9971 (89)
MIT 2	18.6676	18.8179	19.1125	19.5502	19.9030	20.0721	20.0944	20.0944	20.0030	19.5892	19.0808	18.6622 (90)
Living area fraction									fLA = Living area / (4) =			0.3240 (91)
MIT	19.0854	19.2199	19.4841	19.8766	20.2002	20.3609	20.3857	20.3842	20.2914	19.9103	19.4533	19.0784 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0854	19.2199	19.4841	19.8766	20.2002	20.3609	20.3857	20.3842	20.2914	19.9103	19.4533	19.0784 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9952	0.9925	0.9842	0.9528	0.8561	0.6565	0.4696	0.5294	0.8128	0.9636	0.9907	0.9960 (94)
Useful gains	371.6334	393.6039	415.6672	437.2731	420.4629	320.1674	217.3527	226.6944	318.1035	351.0257	352.6632	358.5363 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	894.1763	862.7339	779.3342	647.2275	499.5282	333.2437	218.9872	229.7853	360.3434	547.1319	730.9080	886.5393 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	388.7719	315.2554	270.5683	151.1672	58.8246	0.0000	0.0000	0.0000	0.0000	145.9031	272.3362	392.8343 (98)
Space heating												1995.6609 (98)
Space heating per m2												33.9398 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

 Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1995.6609	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2095.4439	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1802.5405	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	1892.6676	(310a)
Electricity used for heat distribution	39.8811	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	285.3006	(332)
Total delivered energy for all uses	4273.4121	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1329.3705	0.5190	689.9433 (367)
Electrical energy for heat distribution	39.8811	0.5190	20.6983 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			710.6416 (373)
Space and water heating			710.6416 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	285.3006	0.5190	148.0710 (379)
Total CO2, kg/year			858.7126 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6000 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.6000	ZC1
Total Floor Area	TFA	58.8000	
Assumed number of occupants	N	1.9475	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1234	ZC2
CO2 emissions from cooking, equation (L16)		2.8187	ZC3
Total CO2 emissions		34.5421	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.5421	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.8000 (1b)	x 2.6600 (2b)	= 156.4080 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4080 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1279 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3779 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3212 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3613	0.3774 (22b)
Effective ac	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			8.4600	1.3258	11.2159		(27)
Main Type 4	19.0300	8.4600	10.5700	0.1800	1.9026		(29a)
Corridor	19.0300	1.9500	17.0800	0.1800	3.0744		(29a)
PIJ	13.7000		13.7000	0.1300	1.7810		(30)
Total net area of external elements Aum(A, m ²)			51.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	19.9239		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4053 (36)
Total fabric heat loss						(33) + (36) =	25.3292 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1353	29.9673	29.8025	29.0288	28.8840	28.2101	28.2101	28.0853	28.4697	28.8840	29.1769	29.4830 (38)
Heat transfer coeff	55.4645	55.2965	55.1317	54.3580	54.2132	53.5393	53.5393	53.4145	53.7989	54.2132	54.5061	54.8123 (39)
Average = Sum(39)m / 12 =												54.3573 (39)
HLP	0.9433	0.9404	0.9376	0.9245	0.9220	0.9105	0.9105	0.9084	0.9149	0.9220	0.9270	0.9322 (40)
HLP (average)												0.9244 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9475 (42)
Average daily hot water use (litres/day)												80.4534 (43)
Daily hot water use	88.4987	85.2806	82.0624	78.8443	75.6262	72.4080	72.4080	75.6262	78.8443	82.0624	85.2806	88.4987 (44)
Energy conte	131.2410	114.7842	118.4470	103.2650	99.0852	85.5030	79.2311	90.9189	92.0047	107.2226	117.0419	127.0999 (45)
Energy content (annual)										Total = Sum(45)m =		1265.8445 (45)
Distribution loss (46)m = 0.15 x (45)m	19.6862	17.2176	17.7671	15.4897	14.8628	12.8255	11.8847	13.6378	13.8007	16.0834	17.5563	19.0650 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426 (64)
Heat gains from water heating, kWh/month	83.0318	73.7476	78.7778	72.4590	72.3400	66.5531	65.7385	69.6247	68.7149	75.0457	77.0398	81.6549 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755	97.3755 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.1549	14.3486	11.6691	8.8343	6.6037	5.5751	6.0241	7.8304	10.5099	13.3448	15.5753	16.6039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.9107	171.6738	167.2307	157.7720	145.8320	134.6101	127.1132	125.3501	129.7932	139.2519	151.1919	162.4138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375	32.7375 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004	-77.9004 (71)
Water heating gains (Table 5)	111.6018	109.7434	105.8841	100.6375	97.2311	92.4349	88.3582	93.5815	95.4374	100.8678	106.9997	109.7511 (72)
Total internal gains	352.8800	350.9785	339.9966	322.4564	304.8795	287.8328	276.7082	281.9747	290.9531	308.6771	328.9795	343.9814 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

North				8.4600	10.6334	0.6300		0.7000		0.7700		27.4925 (74)	

Solar gains	27.4925	52.5395	89.2775	143.4026	193.1764	206.8011	193.0753	153.1806	107.3405	62.5415	33.9155	22.9191 (83)	
Total gains	380.3725	403.5180	429.2741	465.8590	498.0560	494.6339	469.7834	435.1552	398.2937	371.2186	362.8950	366.9005 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	73.6206	73.8444	74.0650	75.1193	75.3199	76.2679	76.2679	76.4461	75.9000	75.3199	74.9152	74.4967
alpha	5.9080	5.9230	5.9377	6.0080	6.0213	6.0845	6.0845	6.0964	6.0600	6.0213	5.9943	5.9664
util living area	0.9969	0.9949	0.9883	0.9597	0.8628	0.6681	0.4977	0.5570	0.8264	0.9709	0.9936	0.9975 (86)
MIT	20.0921	20.1883	20.3767	20.6491	20.8759	20.9797	20.9970	20.9944	20.9298	20.6610	20.3390	20.0772 (87)
Th 2	20.1309	20.1333	20.1356	20.1468	20.1488	20.1586	20.1586	20.1604	20.1548	20.1488	20.1446	20.1402 (88)
util rest of house	0.9959	0.9933	0.9843	0.9454	0.8193	0.5905	0.4046	0.4593	0.7598	0.9577	0.9912	0.9967 (89)
MIT 2	18.9173	19.0594	19.3345	19.7297	20.0268	20.1450	20.1574	20.1580	20.0983	19.7531	19.2880	18.9027 (90)
Living area fraction	19.2979	19.4251	19.6721	20.0276	20.3019	20.4154	20.4294	20.4290	20.3677	20.0472	19.6285	19.2832 (92)
Temperature adjustment	19.2979	19.4251	19.6721	20.0276	20.3019	20.4154	20.4294	20.4290	20.3677	20.0472	19.6285	19.2832 (93)
adjusted MIT	19.2979	19.4251	19.6721	20.0276	20.3019	20.4154	20.4294	20.4290	20.3677	20.0472	19.6285	19.2832 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9946	0.9915	0.9815	0.9430	0.8279	0.6150	0.4348	0.4911	0.7781	0.9558	0.9893	0.9956 (94)
Ext temp.	378.3356	400.0843	421.3292	439.2996	412.3286	304.1824	204.2788	213.7081	309.9227	354.7945	359.0047	365.2928 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	831.8521	803.1885	726.2019	604.8740	466.3376	311.3534	205.0252	215.2052	337.1940	512.1650	682.8802	826.7439 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	337.4163	270.8861	226.8253	119.2136	40.1827	0.0000	0.0000	0.0000	0.0000	117.0837	233.1904	343.3196 (98)
												1688.1175 (98)
												28.7095 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1805.4733 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	337.4163	270.8861	226.8253	119.2136	40.1827	0.0000	0.0000	0.0000	0.0000	117.0837	233.1904	343.3196	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	360.8730	289.7177	242.5939	127.5012	42.9761	0.0000	0.0000	0.0000	0.0000	125.2232	249.4015	367.1867	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	180.4837	159.2615	167.6897	150.9192	148.3279	133.1572	128.4738	140.1615	139.6589	156.4653	164.6961	176.3426	(64)
Efficiency of water heater (217)m	86.4599	86.2196	85.6202	84.1930	81.8631	79.8000	79.8000	79.8000	79.8000	84.0536	85.7412	86.5614	(216)
Fuel for water heating, kWh/month	208.7483	184.7160	195.8529	179.2539	181.1901	166.8637	160.9947	175.6410	175.0112	186.1495	192.0850	203.7196	(219)
Water heating fuel used												2210.2259	(219)
Annual totals kWh/year													
Space heating fuel - main system												1805.4733	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												285.3006	(232)
Total delivered energy for all uses												4375.9998	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1805.4733	0.2160	389.9822 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2210.2259	0.2160	477.4088 (264)
Space and water heating			867.3910 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	285.3006	0.5190	148.0710 (268)
Total CO2, kg/m2/year			1054.3870 (272)
Emissions per m2 for space and water heating			14.7515 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5182 (272b)
Emissions per m2 for pumps and fans			0.6620 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7515 * 1.55) + 2.5182 + 0.6620, rounded to 2 d.p.			26.0500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-09			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Mid		
Property	Plot 9, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	14.44	TER	26.08
Environmental	89 B	% DER<TER	44.64		
CO ₂ Emissions (t/year)	0.88	DFEE	43.72	TFEE	48.23
General Requirements Compliance	Pass	% DFEE<TFEE	9.35		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.2041 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4541 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3860 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4921	0.4824	0.4728	0.4246	0.4149	0.3667	0.3667	0.3570	0.3860	0.4149	0.4342	0.4535 (22b)
Effective ac	0.6211	0.6164	0.6118	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5943	0.6028 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1700	6.3121	9.0000	334.1700 (29a)
Corridor	4.0200	1.9500	2.0700	0.2257	0.4673	110.0000	227.7000 (29a)
PIJ	27.8100		27.8100	0.1300	3.6153	9.0000	250.2900 (30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.9676		(33)
Party Wall 1			44.5900	0.0000	0.0000	20.0000	891.8000 (32)
Party Floor 1			73.6900			30.0000	2210.7000 (32d)
Party Ceilings 1			45.8800			30.0000	1376.4000 (32b)
Internal Wall 1			174.8700			75.0000	13115.2500 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (User defined value 0.150 * total exposed area)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18406.3100 (34)
249.7803 (35)
12.0675 (36)
(33) + (36) = 40.0351 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.1745	39.8704	39.5723	38.1721	37.9101	36.6906	36.6906	36.4648	37.1603	37.9101	38.4401	38.9941 (38)
Heat transfer coeff	80.2096	79.9055	79.6074	78.2072	77.9452	76.7257	76.7257	76.4999	77.1955	77.9452	78.4752	79.0292 (39)
Average = Sum(39)m / 12 =												78.2060 (39)
HLP	1.0885	1.0843	1.0803	1.0613	1.0577	1.0412	1.0412	1.0381	1.0476	1.0577	1.0649	1.0725 (40)
HLP (average)												1.0613 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)

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Water storage loss:														
Store volume													180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.2000 (48)	
Temperature factor from Table 2b													0.6000 (49)	
Enter (49) or (54) in (55)													0.7200 (55)	
Total storage loss														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)	
If cylinder contains dedicated solar storage														
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month														
	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) = Sum (63)m =						0.0000 (63)
Output from w/h	191.7303	168.9931	177.4831	159.1063	155.9221	139.3268	133.8129	146.8282	146.5670	164.9838	174.4480	187.1188	(64)	
								Total per year (kWh/year) = Sum (64)m =						1946.3205 (64)
Heat gains from water heating, kWh/month														
	85.0601	75.4377	80.3229	73.5252	73.1539	66.9485	65.8026	70.1301	69.3559	76.1669	78.6263	83.5268	(65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	9.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911 (71)
Water heating gains (Table 5)	114.3281	112.2585	107.9609	102.1183	98.3251	92.9841	88.4443	94.2610	96.3276	102.3749	109.2032	112.2672 (72)
Total internal gains	397.2998	395.2146	382.3461	361.6741	340.7663	320.6115	307.5281	313.3604	323.9979	344.8746	368.8175	386.6953 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.7300	10.6334	0.6300	0.7000	0.7700	31.6196 (74)
East	1.7600	19.6403	0.6300	0.7000	0.7700	10.5641 (76)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2796.8280 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2936.6694 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1946.3205 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2043.6365 (310a)
Electricity used for heat distribution	49.8031 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	339.7119 (332)
Total delivered energy for all uses	5320.0178 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1660.1020	0.5190	861.5929 (367)
Electrical energy for heat distribution	49.8031	0.5190	25.8478 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			887.4407 (373)
Space and water heating			887.4407 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	339.7119	0.5190	176.3105 (379)
Total CO2, kg/year			1063.7512 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4400 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER	14.4400 ZC1
Total Floor Area	73.6900
Assumed number of occupants	2.3323
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190
CO2 emissions from appliances, equation (L14)	16.5455 ZC2
CO2 emissions from cooking, equation (L16)	2.3745 ZC3
Total CO2 emissions	33.3600 ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000 ZC7
Net CO2 emissions	33.3600 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.6900 (1b)	x 2.6600 (2b)	= 196.0154 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.6900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.0154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1530 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4030 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3426 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4368	0.4282	0.4197	0.3769	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			11.4900	1.3258	15.2330		(27)
Main Type 4	48.6200	11.4900	37.1300	0.1800	6.6834		(29a)
Corridor	4.0200	1.9500	2.0700	0.1800	0.3726		(29a)
PIJ	27.8100		27.8100	0.1300	3.6153		(30)
Total net area of external elements Aum(A, m ²)			80.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.8543		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8613 (36)
Total fabric heat loss						(33) + (36) =	37.7156 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.5134	38.2738	38.0389	36.9357	36.7293	35.7684	35.7684	35.5905	36.1386	36.7293	37.1469	37.5834 (38)
Heat transfer coeff	76.2290	75.9894	75.7545	74.6513	74.4449	73.4840	73.4840	73.3061	73.8541	74.4449	74.8624	75.2990 (39)
Average = Sum(39)m / 12 =												74.6503 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0345	1.0312	1.0280	1.0130	1.0102	0.9972	0.9972	0.9948	1.0022	1.0102	1.0159	1.0218 (40)
HLP (average)												1.0130 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3323 (42)
Average daily hot water use (litres/day)												89.5916 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.5507	94.9671	91.3834	87.7998	84.2161	80.6324	80.6324	84.2161	87.7998	91.3834	94.9671	98.5507 (44)
Energy conte	146.1479	127.8219	131.9007	114.9943	110.3397	95.2148	88.2305	101.2458	102.4550	119.4014	130.3360	141.5364 (45)
Energy content (annual)										Total = Sum(45)m =		1409.6245 (45)
Distribution loss (46)m = 0.15 x (45)m	21.9222	19.1733	19.7851	17.2491	16.5510	14.2822	13.2346	15.1869	15.3682	17.9102	19.5504	21.2305 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8381 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791 (64)
Heat gains from water heating, kWh/month	87.9883	78.0826	83.2511	76.3590	76.0821	69.7823	68.7308	73.0584	72.1896	79.0951	81.4601	86.4550 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	116.6139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2359	17.0851	13.8946	10.5191	7.8631	6.6384	7.1730	9.3238	12.5143	15.8898	18.5458	19.7705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.7517	207.8868	202.5065	191.0525	176.5939	163.0049	153.9266	151.7915	157.1718	168.6258	183.0844	196.6734	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	34.6614	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	-93.2911	(71)
Water heating gains (Table 5)	118.2639	116.1943	111.8967	106.0541	102.2609	96.9198	92.3801	98.1967	100.2634	106.3106	113.1390	116.2030	(72)
Total internal gains	404.2356	402.1504	389.2819	368.6099	347.7021	327.5473	314.4638	320.2962	330.9337	351.8104	375.7533	393.6310	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				9.7300	10.6334	0.6300	0.7000	0.7700		31.6196 (74)		
East				1.7600	19.6403	0.6300	0.7000	0.7700		10.5641 (76)		
Solar gains	42.1837	81.0923	136.7130	214.5655	283.0059	300.1162	281.3434	227.0999	163.0364	96.4515	52.1790	35.0471 (83)
Total gains	446.4193	483.2427	525.9949	583.1753	630.7080	627.6635	595.8073	547.3961	493.9701	448.2619	427.9323	428.6781 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1314	67.3431	67.5519	68.5502	68.7403	69.6391	69.6391	69.8082	69.2901	68.7403	68.3569	67.9606	
alpha	5.4754	5.4895	5.5035	5.5700	5.5827	5.6426	5.6426	5.6539	5.6193	5.5827	5.5571	5.5307	
util living area	0.9979	0.9963	0.9909	0.9672	0.8847	0.7061	0.5347	0.6001	0.8618	0.9795	0.9958	0.9983	(86)
MIT	19.9226	20.0335	20.2476	20.5566	20.8243	20.9644	20.9937	20.9886	20.8901	20.5617	20.1973	19.9077	(87)
Th 2	20.0547	20.0574	20.0601	20.0725	20.0748	20.0857	20.0857	20.0877	20.0815	20.0748	20.0701	20.0652	(88)
util rest of house	0.9972	0.9951	0.9876	0.9547	0.8431	0.6223	0.4278	0.4892	0.7978	0.9694	0.9941	0.9978	(89)
MIT 2	18.6136	18.7773	19.0907	19.5416	19.8992	20.0616	20.0833	20.0828	19.9900	19.5561	19.0262	18.5994	(90)
Living area fraction	18.9643	19.1138	19.4006	19.8135	20.1470	20.3035	20.3272	20.3254	20.2311	19.8255	19.3399	18.9499	(91)
MIT	18.9643	19.1138	19.4006	19.8135	20.1470	20.3035	20.3272	20.3254	20.2311	19.8255	19.3399	18.9499	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9643	19.1138	19.4006	19.8135	20.1470	20.3035	20.3272	20.3254	20.2311	19.8255	19.3399	18.9499	(93)

8. Space heating requirement

Utilisation	0.9960	0.9933	0.9845	0.9503	0.8468	0.6433	0.4566	0.5190	0.8097	0.9659	0.9922	0.9968	(94)
Useful gains	444.6541	479.9959	517.8182	554.2143	534.0981	403.8072	272.0323	284.1076	399.9538	432.9573	424.5943	427.3150	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1117.8416	1080.0964	977.2776	814.7075	628.8360	419.1143	273.8864	287.7564	452.8088	686.7917	916.3093	1110.6505	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	500.8515	403.2675	341.8378	187.5551	70.4851	0.0000	0.0000	0.0000	0.0000	188.8528	354.0348	508.4016	(98)
Space heating												2555.2862	(98)
Space heating per m2												34.6762	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2732.9264 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	500.8515	403.2675	341.8378	187.5551	70.4851	0.0000	0.0000	0.0000	0.0000	188.8528	354.0348	508.4016	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	535.6700	431.3021	365.6020	200.5937	75.3851	0.0000	0.0000	0.0000	0.0000	201.9816	378.6468	543.7451	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	195.3906	172.2991	181.1434	162.6485	159.5824	142.8690	137.4732	150.4885	150.1092	168.6441	177.9902	190.7791	(64)
Efficiency of water heater (217)m	87.2181	87.0076	86.4835	85.1946	82.7992	79.8000	79.8000	79.8000	79.8000	85.1162	86.6146	79.8000	(216)
Fuel for water heating, kWh/month	224.0254	198.0277	209.4544	190.9142	192.7343	179.0338	172.2722	188.5820	188.1068	198.1340	205.4968	218.5183	(219)
Water heating fuel used												2365.2998	(219)
Annual totals kWh/year													
Space heating fuel - main system												2732.9264	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												339.7119	(232)
Total delivered energy for all uses												5512.9381	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2732.9264	0.2160	590.3121 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2365.2998	0.2160	510.9048 (264)
Space and water heating			1101.2169 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.7119	0.5190	176.3105 (268)
Total CO2, kg/m2/year			1316.4523 (272)
Emissions per m2 for space and water heating			14.9439 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3926 (272b)
Emissions per m2 for pumps and fans			0.5282 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9439 * 1.55) + 2.3926 + 0.5282, rounded to 2 d.p.			26.0800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-10			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Mid		
Property	Plot 10, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	83 B	DER	13.91	TER	24.52
Environmental	89 B	% DER<TER	43.28		
CO ₂ Emissions (t/year)	0.93	DFEE	42.60	TFEE	44.96
General Requirements Compliance	Pass	% DFEE<TFEE	5.25		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3734 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4761	0.4668	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4201	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5844	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1700	6.9972	9.0000	370.4400 (29a)
Corridor	23.8000	1.9500	21.8500	0.2257	4.9323	110.0000	2403.5000 (29a)
PIJ	29.8500		29.8500	0.1300	3.8805	9.0000	268.6500 (30)
Total net area of external elements Aum (m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.1462		(33)
Party Wall 1			22.7600	0.0000	0.0000	20.0000	455.2000 (32)
Party Floor 1			79.4400			40.0000	3177.6000 (32d)
Party Ceilings 1			49.5900			30.0000	1487.7000 (32b)
Internal Wall 1			146.0300			75.0000	10952.2500 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19115.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 240.6261 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 16.1445 (36)
Total fabric heat loss (33) + (36) = 51.2907 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7689	42.4620	42.1613	40.7484	40.4841	39.2536	39.2536	39.0257	39.7275	40.4841	41.0188	41.5779 (38)
Heat transfer coeff	94.0596	93.7527	93.4519	92.0391	91.7748	90.5443	90.5443	90.3164	91.0182	91.7748	92.3095	92.8686 (39)
Average = Sum(39)m / 12 =												92.0379 (39)
HLP	1.1840	1.1802	1.1764	1.1586	1.1553	1.1398	1.1398	1.1369	1.1457	1.1553	1.1620	1.1690 (40)
HLP (average)												1.1586 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)												Total = Sum(45)m = 1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Water storage loss:													
Store volume												180.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.7200 (55)	
Total storage loss													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(56)
If cylinder contains dedicated solar storage													
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200	(57)
Primary loss													
	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(62)
Solar input												0.0000 (63)	
												0.0000	
												0.0000	
												0.0000	
												0.0000	
												0.0000	
Solar input (sum of months) = Sum (63)m =												0.0000 (63)	
Output from w/h													
	196.3745	173.0549	181.6746	162.7605	159.4284	142.3525	136.6166	150.0455	149.8227	168.7781	178.5897	191.6165	(64)
Total per year (kWh/year) = Sum (64)m =												1991.1144 (64)	
Heat gains from water heating, kWh/month													
	86.6043	76.7883	81.7166	74.7402	74.3197	67.9546	66.7348	71.1999	70.4384	77.4285	80.0034	85.0223	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9913	0.9815	0.9608	0.9115	0.8085	0.6246	0.4382	0.4745	0.7222	0.9245	0.9821	0.9933 (94)
Useful gains	555.4431	647.5710	705.4083	716.3991	651.5141	485.8958	328.5260	344.0477	504.3528	584.2013	548.9276	524.6386 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1358.4612	1321.2170	1199.7994	998.8769	767.5998	509.9799	331.9424	349.0788	553.9253	843.7998	1116.9503	1347.5856 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	597.4455	452.6902	367.8270	203.3841	86.3677	0.0000	0.0000	0.0000	0.0000	193.1413	408.9764	612.2726 (98)
Space heating												2922.1047 (98)
Space heating per m2												36.7838 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

 8c. Space cooling requirement

Not applicable

 9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2922.1047 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3068.2099 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1991.1144 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2090.6702 (310a)
Electricity used for heat distribution	51.5888 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (331)
Electricity for lighting (calculated in Appendix L)	357.9139 (332)
Total delivered energy for all uses	5516.7940 (338)

 12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1719.6267	0.5190	892.4863 (367)
Electrical energy for heat distribution	51.5888	0.5190	26.7746 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			919.2608 (373)
Space and water heating			919.2608 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	357.9139	0.5190	185.7573 (379)
Total CO2, kg/year			1105.0182 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9100 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9100 ZC1
Total Floor Area	TFA	79.4400
Assumed number of occupants	N	2.4521
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.2815 ZC2
CO2 emissions from cooking, equation (L16)		2.2388 ZC3
Total CO2 emissions		32.4303 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		32.4303 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.4400 (1b)	x 2.6600 (2b)	= 211.3104 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3332 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4248	0.4165	0.4081	0.3665	0.3582	0.3165	0.3165	0.3082	0.3332	0.3582	0.3748	0.3915 (22b)
	0.5902	0.5867	0.5833	0.5672	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			12.8200	1.3258	16.9962		(27)
Main Type 4	53.9800	12.8200	41.1600	0.1800	7.4088		(29a)
Corridor	23.8000	1.9500	21.8500	0.1800	3.9330		(29a)
PIJ	29.8500		29.8500	0.1300	3.8805		(30)
Total net area of external elements Aum(A, m ²)			107.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1685		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1105 (36)
Total fabric heat loss							(33) + (36) = 46.2790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1580	40.9136	40.6742	39.5493	39.3389	38.3592	38.3592	38.1778	38.7366	39.3389	39.7646	40.2097 (38)
Heat transfer coeff	87.4370	87.1927	86.9532	85.8284	85.6179	84.6382	84.6382	84.4568	85.0156	85.6179	86.0436	86.4887 (39)
Average = Sum(39)m / 12 =												85.8274 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1007	1.0976	1.0946	1.0804	1.0778	1.0654	1.0654	1.0632	1.0702	1.0778	1.0831	1.0887 (40)
HLP (average)												1.0804 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4521 (42)
Average daily hot water use (litres/day)												92.4386 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6824	97.9849	94.2873	90.5898	86.8922	83.1947	83.1947	86.8922	90.5898	94.2873	97.9849	101.6824 (44)
Energy conte	150.7921	131.8837	136.0922	118.6485	113.8460	98.2405	91.0342	104.4631	105.7107	123.1957	134.4777	146.0341 (45)
Energy content (annual)										Total = Sum(45)m =		1454.4184 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6188	19.7826	20.4138	17.7973	17.0769	14.7361	13.6551	15.6695	15.8566	18.4793	20.1717	21.9051 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Heat gains from water heating, kWh/month	89.5325	79.4331	84.6448	77.5740	77.2479	70.7883	69.6630	74.1281	73.2722	80.3567	82.8372	87.9505 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	122.6075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2666	18.0006	14.6391	11.0827	8.2845	6.9941	7.5574	9.8233	13.1849	16.7412	19.5395	20.8298	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.2662	220.5311	214.8236	202.6729	187.3349	172.9193	163.2889	161.0239	166.7315	178.8821	194.2201	208.6357	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	35.2607	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	-98.0860	(71)
Water heating gains (Table 5)	120.3394	118.2041	113.7699	107.7416	103.8279	98.3171	93.6331	99.6346	101.7669	108.0063	115.0517	118.2130	(72)
Total internal gains	421.6544	419.5180	406.0147	384.2795	362.2295	341.0128	327.2616	333.2641	344.4655	366.4119	391.5935	410.4608	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W			
East				3.8000	19.6403	0.6300	0.7000	0.7700	22.8088 (76)			
Southeast				1.0000	36.7938	0.6300	0.7000	0.7700	11.2447 (77)			
South				7.0200	46.7521	0.6300	0.7000	0.7700	100.3020 (78)			
Southwest				1.0000	36.7938	0.6300	0.7000	0.7700	11.2447 (79)			
Solar gains	145.6002	247.1954	335.1446	408.6086	450.5251	443.8337	429.3531	360.8006	272.4616	174.2691	124.6732 (83)	
Total gains	567.2546	666.7134	741.1593	792.8881	812.7546	784.8465	756.6147	732.0612	705.2661	638.8735	565.8626	535.1340 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0931	63.2699	63.4441	64.2756	64.4336	65.1794	65.1794	65.3194	64.8901	64.4336	64.1147	63.7848	
alpha	5.2062	5.2180	5.2296	5.2850	5.2956	5.3453	5.3453	5.3546	5.3260	5.2956	5.2743	5.2523	
util living area	0.9955	0.9891	0.9734	0.9304	0.8324	0.6576	0.4865	0.5222	0.7555	0.9444	0.9897	0.9967	(86)
MIT	19.9317	20.1115	20.3559	20.6398	20.8566	20.9693	20.9948	20.9925	20.9355	20.6561	20.2389	19.9005	(87)
Th 2	20.0003	20.0028	20.0053	20.0169	20.0190	20.0292	20.0292	20.0310	20.0253	20.0190	20.0146	20.0100	(88)
util rest of house	0.9941	0.9856	0.9648	0.9076	0.7809	0.5711	0.3822	0.4166	0.6757	0.9213	0.9858	0.9956	(89)
MIT 2	18.5870	18.8495	19.2019	19.6056	19.8829	20.0093	20.0273	20.0281	19.9774	19.6368	19.0446	18.5486	(90)
Living area fraction									fLA = Living area / (4) =			0.2942	(91)
MIT	18.9826	19.2207	19.5414	19.9098	20.1694	20.2918	20.3119	20.3118	20.2593	19.9367	19.3960	18.9463	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9826	19.2207	19.5414	19.9098	20.1694	20.2918	20.3119	20.3118	20.2593	19.9367	19.3960	18.9463	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	562.7201	654.7098	711.2740	717.3242	641.7339	467.3963	312.4890	327.8008	491.0742	587.1014	555.9645	531.8753	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1283.8004	1248.6634	1133.9881	944.9567	725.1286	481.7396	314.1695	330.3765	523.6351	799.3868	1057.9891	1275.3862	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	536.4837	399.1368	314.4993	163.8954	62.0456	0.0000	0.0000	0.0000	0.0000	157.9404	361.4577	553.1721	(98)
Space heating												2548.6311	(98)
Space heating per m2												(98) / (4) =	32.0825 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2725.8086 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	536.4837	399.1368	314.4993	163.8954	62.0456	0.0000	0.0000	0.0000	0.0000	157.9404	361.4577	553.1721 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	573.7794	426.8843	336.3629	175.2892	66.3590	0.0000	0.0000	0.0000	0.0000	168.9202	386.5858	591.6279 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	200.0348	176.3610	185.3349	166.3027	163.0887	145.8947	140.2769	153.7058	153.3649	172.4383	182.1319	195.2767 (64)
Efficiency of water heater (217)m	87.3201	86.9281	86.2136	84.7750	82.4878	79.8000	79.8000	79.8000	79.8000	84.5807	86.6090	79.8000 (216)
Fuel for water heating, kWh/month	229.0822	202.8814	214.9716	196.1694	197.7125	182.8254	175.7856	192.6138	192.1866	203.8744	210.2921	223.3241 (219)
Water heating fuel used												2421.7191 (219)
Annual totals kWh/year												
Space heating fuel - main system												2725.8086 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												357.9139 (232)
Total delivered energy for all uses												5580.4417 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2725.8086	0.2160	588.7747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2421.7191	0.2160	523.0913 (264)
Space and water heating			1111.8660 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	357.9139	0.5190	185.7573 (268)
Total CO2, kg/m2/year			1336.5483 (272)
Emissions per m2 for space and water heating			13.9963 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3383 (272b)
Emissions per m2 for pumps and fans			0.4900 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9963 * 1.55) + 2.3383 + 0.4900, rounded to 2 d.p.			24.5200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-11			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Top		
Property	Plot 11, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	14.90	TER	30.44
Environmental	87 B	% DER<TER	51.05		
CO ₂ Emissions (t/year)	1.34	DFEE	55.60	TFEE	70.58
General Requirements Compliance	Pass	% DFEE<TFEE	21.22		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1120 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3620 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3077 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3923	0.3846	0.3769	0.3384	0.3307	0.2923	0.2923	0.2846	0.3077	0.3307	0.3461	0.3615 (22b)
Effective ac	0.5769	0.5739	0.5710	0.5573	0.5547	0.5427	0.5427	0.5405	0.5473	0.5547	0.5599	0.5653 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1700	1.8173	9.0000	96.2100 (29a)
Corridor	26.3400	1.9500	24.3900	0.2257	5.5056	110.0000	2682.9000 (29a)
Dwarf	48.7300		48.7300	0.1300	6.3349	9.0000	438.5700 (29a)
PIR	72.4900		72.4900	0.1300	9.4237	9.0000	652.4100 (30)
Flat	52.2800		52.2800	0.1300	6.7964	9.0000	470.5200 (30)
Total net area of external elements Aum, m ²			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9168		(33)
Party Wall 1			8.6800	0.0000	0.0000	20.0000	173.6000 (32)
Party Floor 1			102.2800			40.0000	4091.2000 (32d)
Internal Wall 1			173.3800			9.0000	1560.4200 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10165.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 99.3922 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 33.5820 (36)
Total fabric heat loss (33) + (36) = 83.4988 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.0192	50.7550	50.4960	49.2797	49.0521	47.9928	47.9928	47.7966	48.4008	49.0521	49.5125	49.9938 (38)
Heat transfer coeff	134.5180	134.2538	133.9948	132.7785	132.5509	131.4916	131.4916	131.2954	131.8996	132.5509	133.0113	133.4926 (39)
Average = Sum(39)m / 12 =												132.7774 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3126	1.3101	1.2982	1.2960	1.2856	1.2856	1.2837	1.2896	1.2960	1.3005	1.3052 (40)
HLP (average)												1.2982 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

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	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.7200 (55)
Total storage loss												
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200 (56)
If cylinder contains dedicated solar storage												
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	208.2880	183.4745	192.4267	172.1344	168.4230	150.1141	143.8089	158.2987	158.1745	178.5113	189.2143	203.1541 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	208.2880	183.4745	192.4267	172.1344	168.4230	150.1141	143.8089	158.2987	158.1745	178.5113	189.2143	203.1541 (64)
Heat gains from water heating, kWh/month												
	90.5655	80.2528	85.2916	77.8571	77.3104	70.5353	69.1262	73.9441	73.2154	80.6648	83.5361	88.8585 (65)
Total per year (kWh/year) = Sum(64)m =												2106.0224 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861 (71)
Water heating gains (Table 5)												
	121.7279	119.4238	114.6393	108.1348	103.9118	97.9657	92.9116	99.3872	101.6880	108.4204	116.0224	119.4335 (72)
Total internal gains												
	471.3338	468.9043	453.1339	427.7269	401.7497	377.0265	361.2040	367.8051	381.0917	406.7266	436.0829	458.2710 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North				10.0800	10.6334	0.6300	0.7000			0.7700	32.7570 (74)	
South				3.2700	46.7521	0.6300	0.7000			0.7700	46.7219 (78)	
Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799 (83)
Total gains	550.8127	608.0230	656.9780	708.7529	746.7143	733.9043	699.1933	655.1450	610.8067	563.7764	531.8742	525.9508 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.9923	21.0336	21.0743	21.2673	21.3038	21.4755	21.4755	21.5075	21.4090	21.3038	21.2301	21.1535
alpha	2.3995	2.4022	2.4050	2.4178	2.4203	2.4317	2.4317	2.4338	2.4273	2.4203	2.4153	2.4102
util living area												
	0.9739	0.9654	0.9500	0.9177	0.8571	0.7553	0.6390	0.6794	0.8323	0.9288	0.9644	0.9766 (86)
MIT	18.1649	18.3874	18.8098	19.4058	20.0111	20.5192	20.7794	20.7339	20.3283	19.5736	18.7743	18.1239 (87)
Th 2	19.8290	19.8310	19.8329	19.8423	19.8440	19.8521	19.8521	19.8536	19.8490	19.8440	19.8405	19.8368 (88)
util rest of house												
	0.9696	0.9596	0.9410	0.9012	0.8237	0.6868	0.5234	0.5708	0.7802	0.9113	0.9574	0.9728 (89)
MIT 2	16.0534	16.3773	16.9912	17.8541	18.7090	19.3946	19.7009	19.6586	19.1591	18.1052	16.9480	15.9978 (90)
Living area fraction												
	fLA = Living area / (4) =											0.2516 (91)
MIT	16.5846	16.8830	17.4487	18.2445	19.0366	19.6775	19.9722	19.9291	19.4532	18.4746	17.4074	16.5326 (92)
Temperature adjustment												0.0000
adjusted MIT	16.5846	16.8830	17.4487	18.2445	19.0366	19.6775	19.9722	19.9291	19.4532	18.4746	17.4074	16.5326 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9511	0.9376	0.9145	0.8701	0.7941	0.6744	0.5372	0.5791	0.7576	0.8821	0.9353	0.9556 (94)
Useful gains	523.8643	570.1108	600.7862	616.6984	592.9490	494.9310	375.6175	379.4219	462.7341	497.3038	497.4553	502.5993 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1652.4960	1608.7621	1467.0693	1240.7456	972.4697	667.6460	443.4208	463.3600	706.0873	1043.7850	1371.0062	1646.3157 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	839.7020	697.9736	644.5146	449.3140	282.3634	0.0000	0.0000	0.0000	0.0000	406.5821	628.9566	850.9250 (98)
Space heating												4800.3313 (98)
Space heating per m2												(98) / (4) = 46.9332 (99)

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8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	4800.3313	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	5040.3479	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2106.0224	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2211.3235	(310a)
Electricity used for heat distribution	72.5167	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	445.9101	(332)
Total delivered energy for all uses	7697.5815	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	2417.2238	0.5190	1254.5392 (367)
Electrical energy for heat distribution	72.5167	0.5190	37.6362 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1292.1753 (373)
Space and water heating			1292.1753 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	445.9101	0.5190	231.4273 (379)
Total CO2, kg/year			1523.6027 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9000 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.9000	ZC1
Total Floor Area	TFA	102.2800	
Assumed number of occupants	N	2.7597	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0614	ZC2
CO2 emissions from cooking, equation (L16)		1.8110	ZC3
Total CO2 emissions		31.7724	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.7724	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					40.0000 / (5) = 0.1493 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3993 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3394 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1800	1.9242		(29a)
Corridor	26.3400	1.9500	24.3900	0.1800	4.3902		(29a)
Dwarf	48.7300		48.7300	0.1800	8.7714		(29a)
PIR	72.4900		72.4900	0.1300	9.4237		(30)
Flat	52.2800		52.2800	0.1300	6.7964		(30)
Total net area of external elements Aum(A, m ²)			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.9548		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.1690 (36)
Total fabric heat loss						(33) + (36) =	85.1238 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.4944	52.1729	51.8578	50.3777	50.1008	48.8118	48.8118	48.5730	49.3083	50.1008	50.6610	51.2467 (38)
Heat transfer coeff	137.6181	137.2967	136.9816	135.5015	135.2246	133.9355	133.9355	133.6968	134.4321	135.2246	135.7848	136.3704 (39)
Average = Sum(39)m / 12 =												135.5002 (39)
HLP	1.3455	1.3424	1.3393	1.3248	1.3221	1.3095	1.3095	1.3072	1.3144	1.3221	1.3276	1.3333 (40)
HLP (average)												1.3248 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
Daily hot water use	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
211.9482	186.7806	196.0870	175.6766	172.0832	153.6563	147.4692	161.9590	161.7167	182.1715	192.7565	206.8143	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
211.9482	186.7806	196.0870	175.6766	172.0832	153.6563	147.4692	161.9590	161.7167	182.1715	192.7565	206.8143	(64)
Heat gains from water heating, kWh/month												
93.4937	82.8977	88.2199	80.6908	80.2386	73.3690	72.0544	76.8723	76.0491	83.5930	86.3699	91.7867	(65)
Total per year (kWh/year) = Sum(64)m =												2149.1192 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	(71)
Water heating gains (Table 5)												
125.6636	123.3596	118.5751	112.0706	107.8476	101.9014	96.8474	103.3230	105.6238	112.3562	119.9581	123.3692	(72)
Total internal gains												
478.2696	475.8401	460.0697	434.6627	408.6854	383.9623	368.1397	374.7409	388.0275	413.6624	443.0186	465.2067	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					10.0800	10.6334	0.6300	0.7000	0.7700	32.7570 (74)		
South					3.2700	46.7521	0.6300	0.7000	0.7700	46.7219 (78)		
Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799 (83)
Total gains	557.7485	614.9588	663.9138	715.6886	753.6501	740.8400	706.1291	662.0807	617.7425	570.7122	538.8100	532.8866 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6122	51.7331	51.8521	52.4184	52.5258	53.0313	53.0313	53.1260	52.8354	52.5258	52.3091	52.0844
alpha	4.4408	4.4489	4.4568	4.4946	4.5017	4.5354	4.5354	4.5417	4.5224	4.5017	4.4873	4.4723
util living area	0.9986	0.9976	0.9949	0.9863	0.9575	0.8736	0.7385	0.7881	0.9406	0.9897	0.9974	0.9989 (86)
MIT	19.4561	19.5832	19.8233	20.1691	20.5228	20.8126	20.9394	20.9168	20.6910	20.2508	19.7992	19.4373 (87)
Th 2	19.8054	19.8078	19.8102	19.8215	19.8236	19.8334	19.8334	19.8352	19.8296	19.8236	19.8193	19.8148 (88)
util rest of house	0.9981	0.9967	0.9929	0.9799	0.9341	0.7960	0.5856	0.6472	0.8964	0.9837	0.9963	0.9985 (89)
MIT 2	17.7572	17.9447	18.2969	18.8067	19.3091	19.6880	19.8079	19.7950	19.5469	18.9292	18.2687	17.7360 (90)
Living area fraction	18.1846	18.3569	18.6809	19.1494	19.6145	19.9709	20.0925	20.0772	19.8347	19.2617	18.6537	18.1640 (92)
MIT	18.1846	18.3569	18.6809	19.1494	19.6145	19.9709	20.0925	20.0772	19.8347	19.2617	18.6537	18.1640 (93)
Temperature adjustment												0.0000
adjusted MIT	18.1846	18.3569	18.6809	19.1494	19.6145	19.9709	20.0925	20.0772	19.8347	19.2617	18.6537	18.1640 (93)

8. Space heating requirement

Utilisation	0.9970	0.9950	0.9900	0.9747	0.9286	0.8071	0.6240	0.6813	0.8966	0.9795	0.9946	0.9976 (94)
Useful gains	556.0803	611.8779	657.2933	697.5908	699.8627	597.9197	440.6022	451.0906	553.8750	558.9878	535.8775	531.5958 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1910.7753	1847.5856	1668.5555	1388.8126	1070.2299	719.3545	467.7732	491.6284	770.9277	1171.2735	1568.8191	1904.2770 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1007.8931	830.3956	752.3791	497.6797	275.5532	0.0000	0.0000	0.0000	0.0000	455.5406	743.7179	1021.2749 (98)
Space heating												5584.4340 (98)
Space heating per m2												(98) / (4) = 54.5995 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5972.6567 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1007.8931	830.3956	752.3791	497.6797	275.5532	0.0000	0.0000	0.0000	0.0000	455.5406	743.7179	1021.2749 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1077.9605	888.1236	804.6835	532.2777	294.7093	0.0000	0.0000	0.0000	0.0000	487.2092	795.4202	1092.2726 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	211.9482	186.7806	196.0870	175.6766	172.0832	153.6563	147.4692	161.9590	161.7167	182.1715	192.7565	206.8143 (64)
Efficiency of water heater (217)m	88.4396	88.3253	88.0589	87.4411	86.0638	79.8000	79.8000	79.8000	79.8000	87.1614	88.0694	79.8000 (216)
Fuel for water heating, kWh/month	239.6531	211.4690	222.6770	200.9085	199.9485	192.5517	184.7984	202.9561	202.6525	209.0048	218.8689	233.6843 (219)
Water heating fuel used												2519.1730 (219)
Annual totals kWh/year												
Space heating fuel - main system												5972.6567 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												445.9101 (232)
Total delivered energy for all uses												9012.7398 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5972.6567	0.2160	1290.0938 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2519.1730	0.2160	544.1414 (264)
Space and water heating			1834.2352 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.9101	0.5190	231.4273 (268)
Total CO2, kg/m2/year			2104.5876 (272)
Emissions per m2 for space and water heating			17.9335 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2627 (272b)
Emissions per m2 for pumps and fans			0.3806 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.9335 * 1.55) + 2.2627 + 0.3806, rounded to 2 d.p.			30.4400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	75008-12			Issued on Date	17/09/2021
Assessment Reference	001	Prop Type Ref	HT Top		
Property	Plot 12, Green Lane, NORTHWOOD, HA6 2UZ				
SAP Rating	82 B	DER	14.90	TER	30.44
Environmental	87 B	% DER<TER	51.05		
CO ₂ Emissions (t/year)	1.34	DFEE	55.60	TFEE	70.58
General Requirements Compliance	Pass	% DFEE<TFEE	21.22		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client	Bluesky, Ivan Ball				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1120 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3620 (18)
					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3077 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3923	0.3846	0.3769	0.3384	0.3307	0.2923	0.2923	0.2846	0.3077	0.3307	0.3461	0.3615 (22b)
Effective ac	0.5769	0.5739	0.5710	0.5573	0.5547	0.5427	0.5427	0.5405	0.5473	0.5547	0.5599	0.5653 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.2000	2.3400		(26)
Window (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1700	1.8173	9.0000	96.2100 (29a)
Corridor	26.3400	1.9500	24.3900	0.2257	5.5056	110.0000	2682.9000 (29a)
Dwarf	48.7300		48.7300	0.1300	6.3349	9.0000	438.5700 (29a)
PIR	72.4900		72.4900	0.1300	9.4237	9.0000	652.4100 (30)
Flat	52.2800		52.2800	0.1300	6.7964	9.0000	470.5200 (30)
Total net area of external elements Aum, m ²			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9168		(33)
Party Wall 1			8.6800	0.0000	0.0000	20.0000	173.6000 (32)
Party Floor 1			102.2800			40.0000	4091.2000 (32d)
Internal Wall 1			173.3800			9.0000	1560.4200 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10165.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 99.3922 (35)
Thermal bridges (User defined value 0.150 * total exposed area) 33.5820 (36)
Total fabric heat loss (33) + (36) = 83.4988 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.0192	50.7550	50.4960	49.2797	49.0521	47.9928	47.9928	47.7966	48.4008	49.0521	49.5125	49.9938 (38)
Heat transfer coeff	134.5180	134.2538	133.9948	132.7785	132.5509	131.4916	131.4916	131.2954	131.8996	132.5509	133.0113	133.4926 (39)
Average = Sum(39)m / 12 =												132.7774 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3126	1.3101	1.2982	1.2960	1.2856	1.2856	1.2837	1.2896	1.2960	1.3005	1.3052 (40)
HLP (average)												1.2982 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.7200 (55)
Total storage loss												
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200 (56)
If cylinder contains dedicated solar storage												
	22.3200	20.1600	22.3200	21.6000	22.3200	21.6000	22.3200	22.3200	21.6000	22.3200	21.6000	22.3200 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	208.2880	183.4745	192.4267	172.1344	168.4230	150.1141	143.8089	158.2987	158.1745	178.5113	189.2143	203.1541 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	208.2880	183.4745	192.4267	172.1344	168.4230	150.1141	143.8089	158.2987	158.1745	178.5113	189.2143	203.1541 (64)
Heat gains from water heating, kWh/month												
	90.5655	80.2528	85.2916	77.8571	77.3104	70.5353	69.1262	73.9441	73.2154	80.6648	83.5361	88.8585 (65)
Total per year (kWh/year) = Sum(64)m =												2106.0224 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861 (71)
Water heating gains (Table 5)												
	121.7279	119.4238	114.6393	108.1348	103.9118	97.9657	92.9116	99.3872	101.6880	108.4204	116.0224	119.4335 (72)
Total internal gains												
	471.3338	468.9043	453.1339	427.7269	401.7497	377.0265	361.2040	367.8051	381.0917	406.7266	436.0829	458.2710 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					10.0800	10.6334	0.6300	0.7000	0.7700	32.7570 (74)		
South					3.2700	46.7521	0.6300	0.7000	0.7700	46.7219 (78)		
Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799 (83)
Total gains	550.8127	608.0230	656.9780	708.7529	746.7143	733.9043	699.1933	655.1450	610.8067	563.7764	531.8742	525.9508 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.9923	21.0336	21.0743	21.2673	21.3038	21.4755	21.4755	21.5075	21.4090	21.3038	21.2301	21.1535
alpha	2.3995	2.4022	2.4050	2.4178	2.4203	2.4317	2.4317	2.4338	2.4273	2.4203	2.4153	2.4102
util living area												
	0.9739	0.9654	0.9500	0.9177	0.8571	0.7553	0.6390	0.6794	0.8323	0.9288	0.9644	0.9766 (86)
MIT	18.1649	18.3874	18.8098	19.4058	20.0111	20.5192	20.7794	20.7339	20.3283	19.5736	18.7743	18.1239 (87)
Th 2	19.8290	19.8310	19.8329	19.8423	19.8440	19.8521	19.8521	19.8536	19.8490	19.8440	19.8405	19.8368 (88)
util rest of house												
	0.9696	0.9596	0.9410	0.9012	0.8237	0.6868	0.5234	0.5708	0.7802	0.9113	0.9574	0.9728 (89)
MIT 2	16.0534	16.3773	16.9912	17.8541	18.7090	19.3946	19.7009	19.6586	19.1591	18.1052	16.9480	15.9978 (90)
Living area fraction												
	fLA = Living area / (4) =											0.2516 (91)
MIT	16.5846	16.8830	17.4487	18.2445	19.0366	19.6775	19.9722	19.9291	19.4532	18.4746	17.4074	16.5326 (92)
Temperature adjustment												0.0000
adjusted MIT	16.5846	16.8830	17.4487	18.2445	19.0366	19.6775	19.9722	19.9291	19.4532	18.4746	17.4074	16.5326 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9511	0.9376	0.9145	0.8701	0.7941	0.6744	0.5372	0.5791	0.7576	0.8821	0.9353	0.9556 (94)
Useful gains	523.8643	570.1108	600.7862	616.6984	592.9490	494.9310	375.6175	379.4219	462.7341	497.3038	497.4553	502.5993 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1652.4960	1608.7621	1467.0693	1240.7456	972.4697	667.6460	443.4208	463.3600	706.0873	1043.7850	1371.0062	1646.3157 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	839.7020	697.9736	644.5146	449.3140	282.3634	0.0000	0.0000	0.0000	0.0000	406.5821	628.9566	850.9250 (98)
Space heating												4800.3313 (98)
Space heating per m2												(98) / (4) = 46.9332 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	4800.3313	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	5040.3479	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2106.0224	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2211.3235	(310a)
Electricity used for heat distribution	72.5167	(313)
Annual totals kWh/year		
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(331)
Electricity for lighting (calculated in Appendix L)	445.9101	(332)
Total delivered energy for all uses	7697.5815	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	2417.2238	0.5190	1254.5392 (367)
Electrical energy for heat distribution	72.5167	0.5190	37.6362 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1292.1753 (373)
Space and water heating			1292.1753 (376)
Pumps and fans	0.0000	0.0000	0.0000 (378)
Energy for lighting	445.9101	0.5190	231.4273 (379)
Total CO2, kg/year			1523.6027 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9000 (384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.9000	ZC1
Total Floor Area	TFA	102.2800	
Assumed number of occupants	N	2.7597	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0614	ZC2
CO2 emissions from cooking, equation (L16)		1.8110	ZC3
Total CO2 emissions		31.7724	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.7724	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	102.2800 (1b)	x 2.6200 (2b)	= 267.9736 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 267.9736 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1493 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3993 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3394 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5795 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			13.3500	1.3258	17.6989		(27)
Main Type 4	24.0400	13.3500	10.6900	0.1800	1.9242		(29a)
Corridor	26.3400	1.9500	24.3900	0.1800	4.3902		(29a)
Dwarf	48.7300		48.7300	0.1800	8.7714		(29a)
PIR	72.4900		72.4900	0.1300	9.4237		(30)
Flat	52.2800		52.2800	0.1300	6.7964		(30)
Total net area of external elements Aum(A, m ²)			223.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.9548		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.1690 (36)
Total fabric heat loss						(33) + (36) =	85.1238 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.4944	52.1729	51.8578	50.3777	50.1008	48.8118	48.8118	48.5730	49.3083	50.1008	50.6610	51.2467 (38)
Heat transfer coeff	137.6181	137.2967	136.9816	135.5015	135.2246	133.9355	133.9355	133.6968	134.4321	135.2246	135.7848	136.3704 (39)
Average = Sum(39)m / 12 =												135.5002 (39)
HLP	1.3455	1.3424	1.3393	1.3248	1.3221	1.3095	1.3095	1.3072	1.3144	1.3221	1.3276	1.3333 (40)
HLP (average)												1.3248 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7597 (42)
Average daily hot water use (litres/day)												99.7418 (43)
Daily hot water use	109.7159	105.7263	101.7366	97.7469	93.7573	89.7676	89.7676	93.7573	97.7469	101.7366	105.7263	109.7159 (44)
Energy conte	162.7056	142.3033	146.8443	128.0224	122.8406	106.0021	98.2265	112.7163	114.0625	132.9289	145.1023	157.5717 (45)
Energy content (annual)										Total = Sum(45)m =		1569.3264 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4058	21.3455	22.0266	19.2034	18.4261	15.9003	14.7340	16.9075	17.1094	19.9393	21.7653	23.6357 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	211.9482	186.7806	196.0870	175.6766	172.0832	153.6563	147.4692	161.9590	161.7167	182.1715	192.7565	206.8143 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	211.9482	186.7806	196.0870	175.6766	172.0832	153.6563	147.4692	161.9590	161.7167	182.1715	192.7565	206.8143 (64)
Heat gains from water heating, kWh/month	93.4937	82.8977	88.2199	80.6908	80.2386	73.3690	72.0544	76.8723	76.0491	83.5930	86.3699	91.7867 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	137.9827	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2493	22.4262	18.2382	13.8075	10.3213	8.7136	9.4154	12.2385	16.4265	20.8572	24.3434	25.9510	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.9619	262.6595	255.8616	241.3898	223.1218	205.9524	194.4822	191.7846	198.5824	213.0542	231.3223	248.4917	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	36.7983	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	-110.3861	(71)
Water heating gains (Table 5)	125.6636	123.3596	118.5751	112.0706	107.8476	101.9014	96.8474	103.3230	105.6238	112.3562	119.9581	123.3692	(72)
Total internal gains	478.2696	475.8401	460.0697	434.6627	408.6854	383.9623	368.1397	374.7409	388.0275	413.6624	443.0186	465.2067	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					10.0800	10.6334	0.6300		0.7000	0.7700				32.7570 (74)
South					3.2700	46.7521	0.6300		0.7000	0.7700				46.7219 (78)
Solar gains	79.4789	139.1187	203.8441	281.0259	344.9646	356.8778	337.9893	287.3399	229.7149	157.0498	95.7914	67.6799 (83)		
Total gains	557.7485	614.9588	663.9138	715.6886	753.6501	740.8400	706.1291	662.0807	617.7425	570.7122	538.8100	532.8866 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.6122	51.7331	51.8521	52.4184	52.5258	53.0313	53.0313	53.1260	52.8354	52.5258	52.3091	52.0844
alpha	4.4408	4.4489	4.4568	4.4946	4.5017	4.5354	4.5354	4.5417	4.5224	4.5017	4.4873	4.4723
util living area	0.9986	0.9976	0.9949	0.9863	0.9575	0.8736	0.7385	0.7881	0.9406	0.9897	0.9974	0.9989 (86)
MIT	19.4561	19.5832	19.8233	20.1691	20.5228	20.8126	20.9394	20.9168	20.6910	20.2508	19.7992	19.4373 (87)
Th 2	19.8054	19.8078	19.8102	19.8215	19.8236	19.8334	19.8334	19.8352	19.8296	19.8236	19.8193	19.8148 (88)
util rest of house	0.9981	0.9967	0.9929	0.9799	0.9341	0.7960	0.5856	0.6472	0.8964	0.9837	0.9963	0.9985 (89)
MIT 2	17.7572	17.9447	18.2969	18.8067	19.3091	19.6880	19.8079	19.7950	19.5469	18.9292	18.2687	17.7360 (90)
Living area fraction												
MIT	18.1846	18.3569	18.6809	19.1494	19.6145	19.9709	20.0925	20.0772	19.8347	19.2617	18.6537	18.1640 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1846	18.3569	18.6809	19.1494	19.6145	19.9709	20.0925	20.0772	19.8347	19.2617	18.6537	18.1640 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9970	0.9950	0.9900	0.9747	0.9286	0.8071	0.6240	0.6813	0.8966	0.9795	0.9946	0.9976	(94)
Useful gains	556.0803	611.8779	657.2933	697.5908	699.8627	597.9197	440.6022	451.0906	553.8750	558.9878	535.8775	531.5958	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1910.7753	1847.5856	1668.5555	1388.8126	1070.2299	719.3545	467.7732	491.6284	770.9277	1171.2735	1568.8191	1904.2770	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1007.8931	830.3956	752.3791	497.6797	275.5532	0.0000	0.0000	0.0000	0.0000	455.5406	743.7179	1021.2749	(98)
Space heating												5584.4340	(98)
Space heating per m2												54.5995	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5972.6567 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1007.8931	830.3956	752.3791	497.6797	275.5532	0.0000	0.0000	0.0000	0.0000	455.5406	743.7179	1021.2749 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1077.9605	888.1236	804.6835	532.2777	294.7093	0.0000	0.0000	0.0000	0.0000	487.2092	795.4202	1092.2726 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	211.9482	186.7806	196.0870	175.6766	172.0832	153.6563	147.4692	161.9590	161.7167	182.1715	192.7565	206.8143 (64)
Efficiency of water heater (217)m	88.4396	88.3253	88.0589	87.4411	86.0638	79.8000	79.8000	79.8000	79.8000	87.1614	88.0694	79.8000 (216)
Fuel for water heating, kWh/month	239.6531	211.4690	222.6770	200.9085	199.9485	192.5517	184.7984	202.9561	202.6525	209.0048	218.8689	233.6843 (219)
Water heating fuel used												2519.1730 (219)
Annual totals kWh/year												
Space heating fuel - main system												5972.6567 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												445.9101 (232)
Total delivered energy for all uses												9012.7398 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5972.6567	0.2160	1290.0938 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2519.1730	0.2160	544.1414 (264)
Space and water heating			1834.2352 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.9101	0.5190	231.4273 (268)
Total CO2, kg/m2/year			2104.5876 (272)
Emissions per m2 for space and water heating			17.9335 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2627 (272b)
Emissions per m2 for pumps and fans			0.3806 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.9335 * 1.55) + 2.2627 + 0.3806, rounded to 2 d.p.			30.4400 (273)

Appendix 4: 'Be Clean' GLA SAP 10 Spreadsheet

Be Clean - SAP 2012 Methodology SAP 10 Carbon Factors

Project

Client

Date

Rev

Wetherby House, 15 Green Lane, Northwood

Oct-21

A



	Carbon		Carbon
SAP 2012	Factor	SAP 10	Factor
Gas	0.216	Gas	0.210
Grid Elec	0.519	Grid Elec	0.233

Residential Accommodation

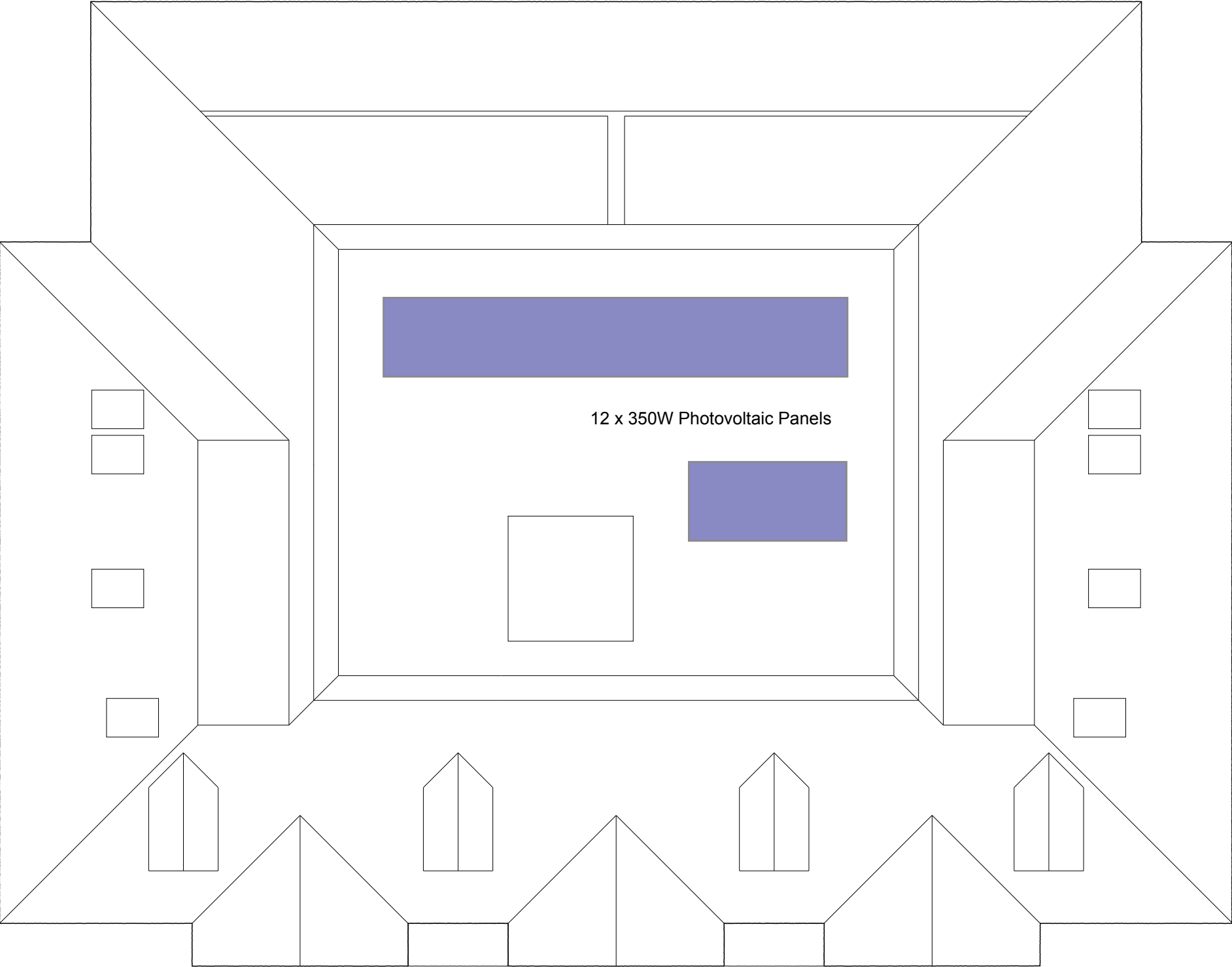
TER								
Plot	Bedrooms	Floor Area	Location	Space Htg	Water Htg	Pumps & Fans	Lighting	Emissions
1	2	79.4	GND	2980	2417	75	353	1233.1
2	2	73.7	GND	3052	2359	75	340	1233.0
3	1	58.8	GND	2228	2199	75	285	1013.6
4	2	73.7	GND	3052	2359	75	340	1233.0
5	2	79.4	GND	2980	2417	75	353	1233.1
6	2	79.4	MID	2726	2422	75	358	1182.0
7	2	73.7	MID	2733	2365	75	340	1167.3
8	1	58.8	MID	1805	2210	75	285	927.0
9	2	73.7	MID	2733	2365	75	340	1167.3
10	2	79.4	MID	2726	2422	75	358	1182.0
11	2	102.3	TOP	5973	2519	75	446	1904.7
12	2	102.3	TOP	5973	2519	75	446	1904.7
934.7								15380.7

DER - Based on ASHP with SAP 10 Carbon Factors					
Plot	Heating	Distribution	Pumps & Fans	Lighting	Emissions
1	1742	52	0	353	500.3
2	1764	53	0	340	502.6
3	1445	43	0	285	413.1
4	1764	53	0	340	502.6
5	1742	52	0	353	500.3
6	1720	52	0	358	496.3
7	1660	50	0	340	477.7
8	1329	40	0	285	385.4
9	1660	50	0	340	477.7
10	1720	52	0	358	496.3
11	2417	73	0	446	684.1
12	2417	73	0	446	684.1
					6120.2

Total Site Design Emissions (Be Clean)

6,120 kgCO₂ per year

Appendix 5 – Roof Plan showing Indicative Location of Photovoltaic Panels



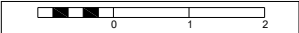
Rev	Date	Description



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Client :
Green Lane Estates Ltd
Wetherbys Nursery Green Lane, Northwood
Roof Plan



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Scale 1:100 @ A3	Dwg No. FLU.441.3.09
Date 24.02.19	Rev
Drawn N.Millin	